Savannah River Site
Solid Waste Management Department
Consolidated Incinerator Facility
Operator Training Program

RADIOACTIVE ORGANIC WASTE (U)

Study Guide

ZIOITX14

Revision 02

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Training Manager / Date

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Engineering / Date

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Facility Manager / Date

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REVISION LOG

REV.	AFFECTED SECTION(S)	SUMMARY OF CHANGE
00	All	New Issue
01	All	Update
02	All	Format change and update

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

REFERENCES

1. 261-SOP-ROW-01, *Rad Organic Waste,* Rev. 1
2. SE5-2-2006177 *CIF Tank Farm Logic Diagram,* Sheet 3 Instruments, Rev. 1
3. SE5-2-2006177 CIF *Tank Farm Logic Diagram,* Sheet 9 Instruments, Rev. 1
4. Drawing W2017829 *Rad Organic Feed Pumps Process Serv PPG & Ins Process and Instrument*, Rev. 5
5. Drawing W2022341 *Rad Organic Recirc. System From S-Area to Tank Farm Process Piping & Instrument Diagram Process & Instruments*, Rev. 1
6. Drawing W754061 Savannah River Plant 200S Area Defense Waste Processing Facility - *Sludge Plant Organic Waste Storage Tank (sh1 of 2) Piping & Instrument Diagram*
7. Drawing W775092 Savannah River Plant 200S Area Defense Waste Processing Facility - Sludge Plant PFD-11F *Organic Waste Storage System Performance Diagram*
8. Drawing W836368 Savannah River Site Building 261-H Area 200-H *SCC Rad. Organic Burner Sh1 Pwr, Serv. PPG. & Instr. Diag. Power and Instruments,* Rev. 8
9. Drawing W836369 Savannah River Site Building 261-H Area 200-H *SCC Rad. Organic Burner Sh2 Pwr, Serv. PPG. & Instr. Diag. Power and Instruments,* Rev. 14
10. WSRC-SA-17, *Consolidated Incineration Facility Safety Analysis Report* (DOE Approval Copy 12/95)
11. ZIOITX14, *Radioactive Organic Waste Systems Design Description,* Rev. 0

LEARNING OBJECTIVES

TERMINAL OBJECTIVE

1.00 Without references, **EXPLAIN** the significance of the Radioactive Organic Waste (ROW) System to Consolidated Incinerator Facility operations, including its importance to safety, and the impact on operations of a failure of the system.

ENABLING LEARNING OBJECTIVES

1.01 **IDENTIFY** the hazards associated with the ROW System.

1.02 **STATE** the purpose of the ROW System.

1.03 Briefly **DESCRIBE** how the ROW System accomplishes its intended purpose.

1.04 **EXPLAIN** the consequences of a failure of the ROW System to fulfill its intended purpose, including the effects on other systems or components, overall plant operation, and safety.

TERMINAL OBJECTIVE

2.00 Using system diagrams, **EVALUATE** potential problems which could interfere with normal ROW System flowpaths to determine their significance on overall system operation and the corrective actions needed to return the system to normal.

ENABLING LEARNING OBJECTIVES

2.01 **DESCRIBE** the physical layout of the ROW System components including the general location, interfaces with other systems, how many there are, and the functional relationship for each of the following major components:

a. Organic Waste Storage Tank (OWST)
b. OWST Pump
c. ROW Transfer Line
d. ROW Feed Pumps
e. SCC remote & local skids
f. Secondary Combustion Chamber (SCC) ROW Burner

2.02 **DESCRIBE** the ROW System arrangement to include a drawing showing the following system components and interfaces with other systems:

a. Organic Waste Storage Tank (OWST)
b. OWST Pump
c. ROW Transfer Line
d. ROW Feed Pumps
e. SCC remote & local skids
f. Secondary Combustion Chamber (SCC) ROW Burner

2.03 Given a description of the ROW System equipment status, **IDENTIFY** conditions which interfere with normal system flowpaths.

2.04 Given a description of abnormal equipment status for the ROW System, **EXPLAIN** the significance of the condition on system operation.

2.05 Given a description of the ROW System equipment status, **STATE** any corrective actions required to return system operation to a normal condition.

TERMINAL OBJECTIVE

3.00 Given values of ROW System operation parameters, **EVALUATE** problems that could effect the normal functioning of the system or its components to determine the significance of the existing condition and the actions required to return the system to normal operation.

ENABLING LEARNING OBJECTIVES

3.01 **DESCRIBE** the following major components of the ROW System including their functions, principles of operation, and basic construction:

a. Organic Waste Storage Tank (OWST)
b. OWST Pump
c. ROW Transfer Line
d. Leak Detection System
e. ROW Feed Pumps
f. SCC remote & local skids
g. Secondary Combustion Chamber (SCC) ROW Burner

3.02 **STATE** the operational limitations for the following ROW System major components:

a. ROW Feed Pumps
b. Secondary Combustion Chamber (SCC) ROW Burner
c. ROW Transfer Line

3.03 Given values for key performance indicators, **DETERMINE** if ROW System components are functioning as expected.

3.04 **DESCRIBE** the following ROW System instrumentation including indicator location (local or Control Room), sensing points, and associated instrument controls:

a. SCC ROW steam flow
b. SCC ROW steam pressure
c. ROW feed flow
d. ROW transfer flow
e. ROW recirculation
f. ROW temperature
g. Leak detection

3.05 **INTERPRET** the following ROW System alarms, including the conditions causing alarm actuation and the basis for the alarms:

a. SCC ROW steam flow
b. SCC ROW steam pressure
c. ROW feed flow
d. ROW feed pressure
e. ROW recirculation
f. ROW temperature
g. Leak detection

3.06 **EXPLAIN** how the following ROW System equipment is controlled in all operating modes or conditions to include control locations (local or Control Room), basic operating principles of control devices, and the effects of each control on the component operation:

a. ROW Feed Pumps

b. ROW System nitrogen purge valve 0628HV

c. ROW transfer valve 0609HV

3.07 **DESCRIBE** the interlocks associated with the following ROW System equipment to include the interlock actuating conditions, effects of interlock actuation, and the reason the interlock is necessary:

a. ROW purge valve 0628HV

b. ROW transfer valve 0609HV

TERMINAL OBJECTIVE

4.00 Given necessary procedures or other technical documents and system conditions, **DETERMINE** the operator actions required for normal and offnormal operation of the ROW System including problem recognition and resolution.

ENABLING LEARNING OBJECTIVES

4.01 Given applicable procedures and plant conditions, **DETERMINE** the actions necessary to perform the following ROW System operations:

a. Startup

b. Manual Operation of Equipment

c. Shutdown

4.02 **DETERMINE** the effects on the ROW System and the integrated plant response when given any of the following:

a. Indications/alarms

b. Malfunctions/failure of components

c. Operator Actions

SYSTEM OVERVIEW

Safety

All personnel should be aware of the importance of safety. To prevent any mishaps from occurring, personnel should follow the guidelines set forth in WSRC 4Q, *Industrial Hygiene Manual* and WSRC 8Q, *Employee Safety Manual*.

Introduction

Radioactive Organic Waste (ROW) is a byproduct of the processes occurring at the In-Tank-Precipitation (ITP) facility located adjacent to the H-Area Tank Farm. The primary component of ROW is the chemical Benzene. The ITP facility prepares and concentrates the high level radioactive wastes, accumulated at the tank farms, for solidification into a glass matrix at the Defense Waste Processing Facility (DWPF).

Sodium Tetraphenalborate, added at the ITP facility as part of the chemical process, decomposes to various chemicals including Benzene. Some of the Benzene is removed at the ITP facility and vented to atmosphere with the remaining portion of the Benzene transferred, along with the high level waste, to DWPF. DWPF utilizes a process called Latewash which will result in additional benzene production as well as some atmospheric venting.

In the DWPF, residual chemicals, including Benzene, are removed prior to glassification. This organic waste, along with some trace radioactive elements, is accumulated in the 150,000 gallon Organic Waste Storage Tank (OWST) until it can be incinerated or transported offsite for disposal. The OWST has the capacity to store the expected volume of Benzene generated by DWPF over a three-year period.

The design of the Consolidated Incineration Facility (CIF) includes an overhead pipe loop (ROW Transfer Line) connecting the OWST to the CIF Tank Farm. The overhead line contains a transfer line and a recirculation line. Once the ROW has arrived at the CIF, it is fed into the Secondary Combustion Chamber (SCC) of the Incinerator for incineration.

High temperature incineration of the Benzene will result in its breakdown to less hazardous compounds and the concentration of the radioactive elements for an overall volume reduction of the material. Table 1, *ROW Composition,* lists the chemicals by percent of composition that make up ROW.

COMPONENTS	WEIGHT %
Benzene	90.770
Biphenyl	4.950
Diphenylamine	3.370
Phenol	0.730
Phenylboric Acid	0.063
p-Terphenyl	0.074
Diphenyl Mercury	0.028
Chlorobenzine	0.015

Table 1 ROW Composition

ELO 1.01	**IDENTIFY the hazards associated with the ROW System.**

Hazards Associated with ROW

Benzene is an organic (it contains carbon), ring-structured compound that is highly flammable, as well as a human health hazard. It is a suspected human carcinogen with an 8-hour airborne exposure limit at 1 ppm. Acute effects to skin exposure include irritation and blistering. Chronic exposure to elevated concentration can result in blood disorders such as anemia and leukemia. High vapor concentrations can cause depression, coma, or death. Skin exposed to Benzene should be washed with soap and water. Eyes exposed to Benzene should be flushed with water for at least 15 minutes. Vomiting should not be induced if the chemical is ingested.

In addition to the hazards associated with Benzene, ROW also contains trace amounts of radioactive materials which require observance of normal radiological concerns and controls.

Responsibility

DWPF personnel are responsible for the operation and maintenance of the OWST and its associated pump and valves. CIF personnel are responsible for the piping between DWPF and the CIF, in addition to all of the associated piping, pumps, and valves at the CIF.

The division of responsibilities between the two facilities is as follows: DWPF Operations is responsible for operation of the OWST Pump and the Transfer Line valves at the OWST. CIF operations is responsible for the valves at the CIF, the Transfer Line leak detection, Heat Trace, ROW Feed Pumps, Nitrogen Purge System, and Nitrogen Vent System.

SYSTEM PURPOSE

ELO 1.02 STATE the purpose of the ROW System.

The three purposes of the ROW System are to: (1) transport the ROW between DWPF and CIF through an overhead transfer line by a transfer pump in the OWST to feed pumps located in the tank farm; (2) ROW Feed Pumps transport and meter ROW flow to the SCC remote and local skids where instruments monitor feed to the SCC to maintain peak efficiency of the incineration process; (3) provide sampling capabilities.

ELO 1.03 Briefly DESCRIBE how the ROW System accomplishes its intended purpose.

The OWST is equipped with a submersible pump which provides the driving force to move the ROW between the DWPF and the CIF. In addition, the pump provides the driving force for the recirculation of the OWST.

ROW Feed Pumps provide the metered flow into the SCC ROW Burner to maintain peak efficiency of the incineration process in conjunction with the Burner Management System (BMS). During normal operations, 95-98% of the flow in the system is recirculated back to the OWST through the recirculation flowpath with 2-5% of the ROW liquid flow fed to the SCC ROW Burner.

The ROW System sample flowpath utilizes the same flowpath as the recirculation flowpath with a small amount of flow directed through the Automatic Sampler to the selected Blend Tank in accordance with 261-SOP-ROW-01, “RAD ORGANIC WASTE”. ROW must be sampled prior to initiating ROW feed to the SCC and the ROW System must be in recirculation mode for at least 20 minutes prior to sampling.

ELO 1.04	EXPLAIN the consequences of a failure of the ROW System to fulfill its intended purpose, including the effects on other systems or components, overall plant operation, and safety.

If the OWST transfer pump were to fail, it would preclude operation of the SCC ROW burner due to a lack of feed from the OWST to the CIF ROW feed pumps, located in the tank farm. The DWPF would be responsible for the repair of any equipment/ piping from the OWST up to the point where the ROW Transfer Line crosses the CIF boundary fence.

A failure of the ROW feed pump would most likely cause a temporary shutdown of the ROW burner due to a loss of flow to the remote and local skids, which contain instrumentation to monitor and control the feeding of ROW to the SCC. The standby or secondary ROW feed pump could be used to continue /restart the ROW burner if desired.

A failure of the automatic sampler would prevent obtaining a sample of the ROW before it is incinerated. The CIF would not be able to initiate ROW feed to the SCC until the automatic sampler were repaired/returned to service and a sample of ROW obtained in accordance with 261-SOP-ROW-01, “RAD ORGANIC WASTE”, section 4.4.

Failure of any associated piping or valving, resulting in a leak of ROW, would present a safety hazard to personnel, and require the shutdown of the ROW burner to mitigate the circumstances of the leak. The ROW System is not required to be in operation to incinerate solid waste, blended waste, or aqueous waste. The only way a ROW leak can affect the overall operation of the CIF would be if a combustible gas detector actuated an alarm and incinerator automatic shutdown.

DESCRIPTION & FLOWPATH

ELO 2.01	**DESCRIBE the physical layout of the ROW System components including, the general location, interfaces with other systems, how many there are, and the functional relationship for each of the following major components:** **a. Organic Waste Storage Tank (OWST)** **b. OWST Pump** **c. ROW Transfer Line** **d. ROW Feed Pumps** **e. SCC remote & local skids** **f. Secondary Combustion Chamber (SCC) ROW Burner**

The OWST provides an interim storage space for organic waste from the DWPF Organic Evaporator Condensate Tank (OECT). The contents of the OECT are periodically batch transferred to the OWST. DWPF has committed to sample materials prior to pumping them to the OWST, and to make the sample results available to the CIF. It is estimated that approximately 150 gallons per day of ROW will be produced at the DWPF. The OWST has a capacity of 150,000 gallons which was designed to store three-years' production of ROW. The DWPF will not be able to let the OWST level drop below 25-30% full in order to maintain the floating roof properly.

The OWST is equipped with a submersible pump which provides the driving force to move the ROW between the DWPF and the CIF. In addition, the pump provides the driving force for the recirculation of the OWST.

(See Figure 1, *ROW System P&ID.*) The ROW System consists of the Transfer Line between the DWPF and the CIF with associated leak detection monitoring, two ROW Feed Pumps, and the SCC ROW Burner with local and remote burner skids.

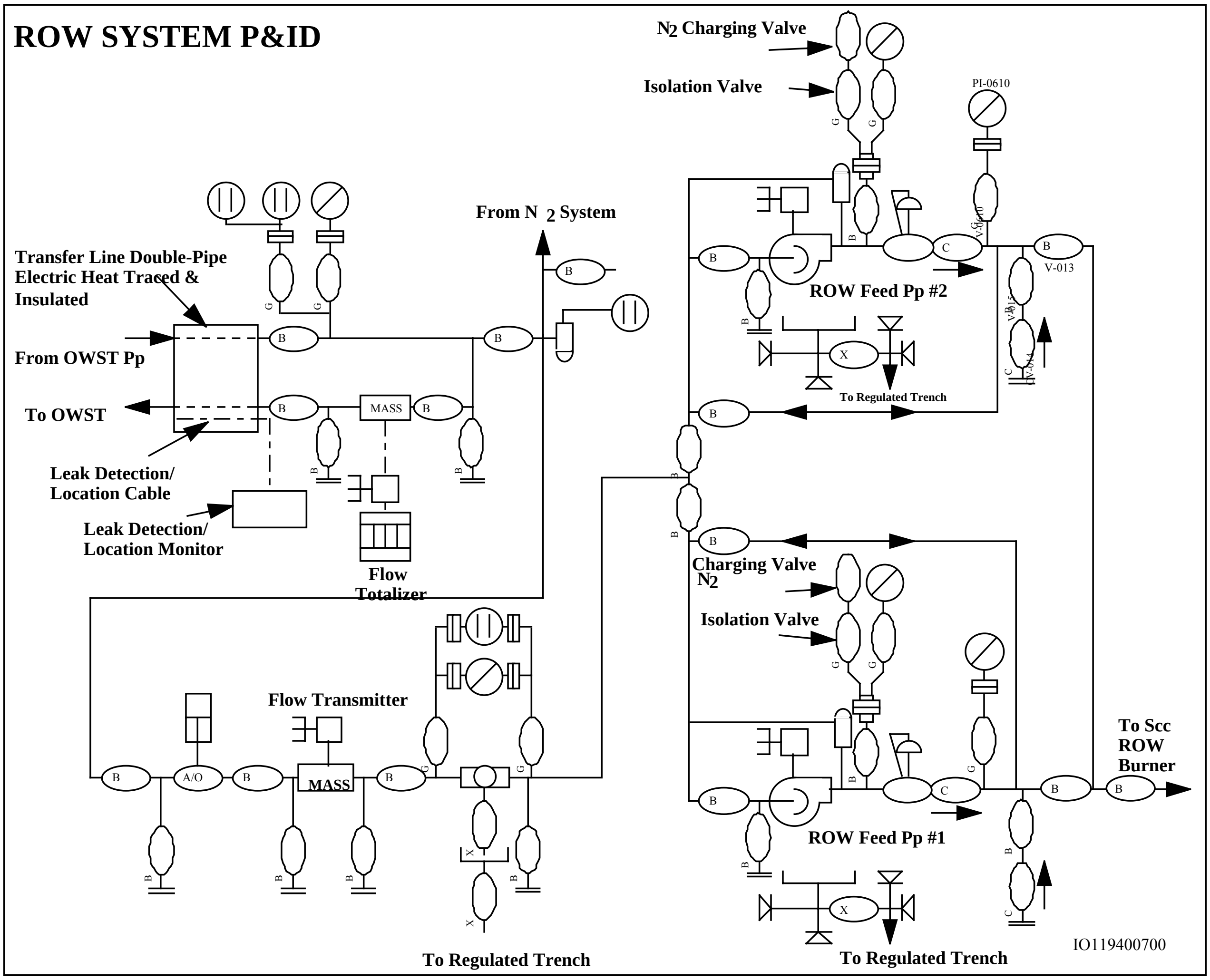

Figure 1 ROW System Diagram

ELO 2.02	**DESCRIBE the ROW System arrangement to include a drawing showing the following system components and interfaces with other systems:** **a. Organic Waste Storage Tank (OWST)** **b. OWST Pump** **c. ROW Transfer Line** **d. ROW Feed Pumps** **e. SCC remote & local skids** **f. Secondary Combustion Chamber (SCC) ROW Burner**

(See Figure 2, *Simplified ROW System Diagram.*) The following diagram is a simplified to aid in the understanding of the overall ROW System flowpath from the OWST at DWPF, to the SCC at CIF.

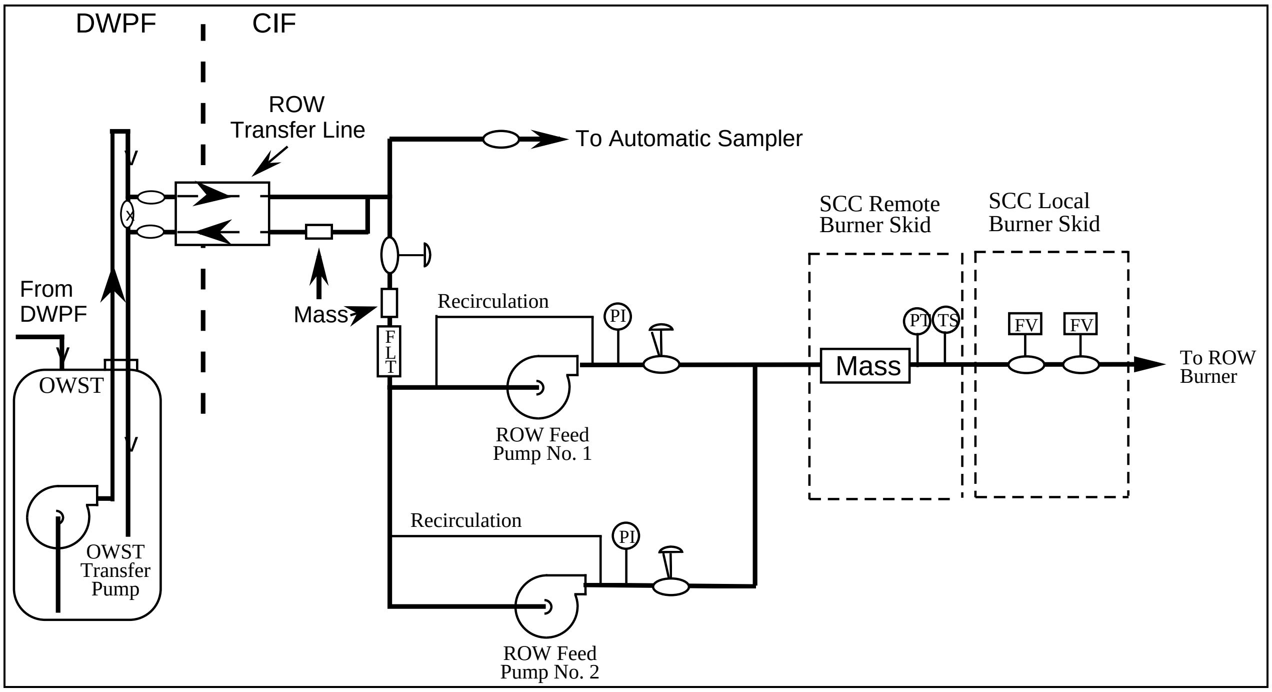

Figure 2 Simplified ROW System Diagram

Recirculation Flow-Path

(See Figure 3, *ROW Recirculation Flowpath Diagram.*) The recirculation flowpath originates in the OWST. The OWST pump is submerged in the OWST, and pumps ROW through the overhead transfer line. 100% of the ROW flow (nominally 25 gpm) from the OWST Pump is recirculated back to the OWST.

Primarily, recirculation prevents settling of any particulate in the piping which would occur if the only flow established was that provided to the ROW Feed Pumps. The amount of flow provided for burner feed is very small, nominally 1/3 gpm. The velocity of this flow would not be sufficient to maintain any particulate in solution. Recirculation also provides mixing of the contents of the OWST prior to sampling, and while feeding the ROW Burner. ROW is required to be recirculated for a minimum of 20 minutes prior to obtaining a sample at CIF.

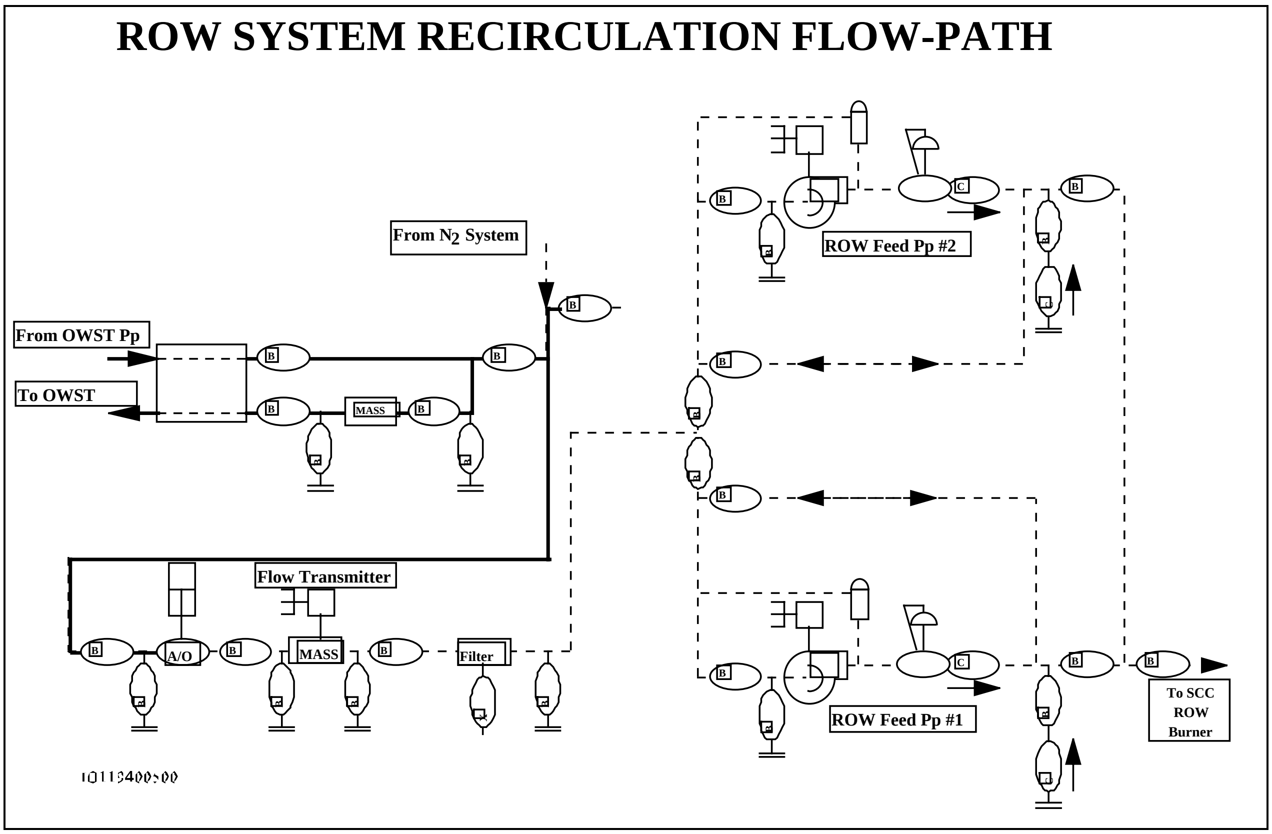

Figure 3 ROW System Recirculation Flowpath

Sample Flowpath

(See Figure 4, *ROW System Sample Flowpath Diagram.*) The ROW System sample flowpath utilizes the same flowpath as the recirculation flowpath with a small amount of flow directed through the Automatic Sampler to the selected Blend Tank. It should be noted that the sample flowrate through the automatic sampler is approximately 15 gpm. Since the return path for sampling ROW has to be lined up to one of the blend tanks, it is important to complete this sample in a timely manner.

Applied Concept: If it takes two hours to obtain a sample of ROW with the automatic sampler, how many gallons of ROW have been sent to one of the blend tanks?

2 hours X 60 minutes per hour X 15 gallons per minute = <u>1800 gallons added to a blend tank.</u>

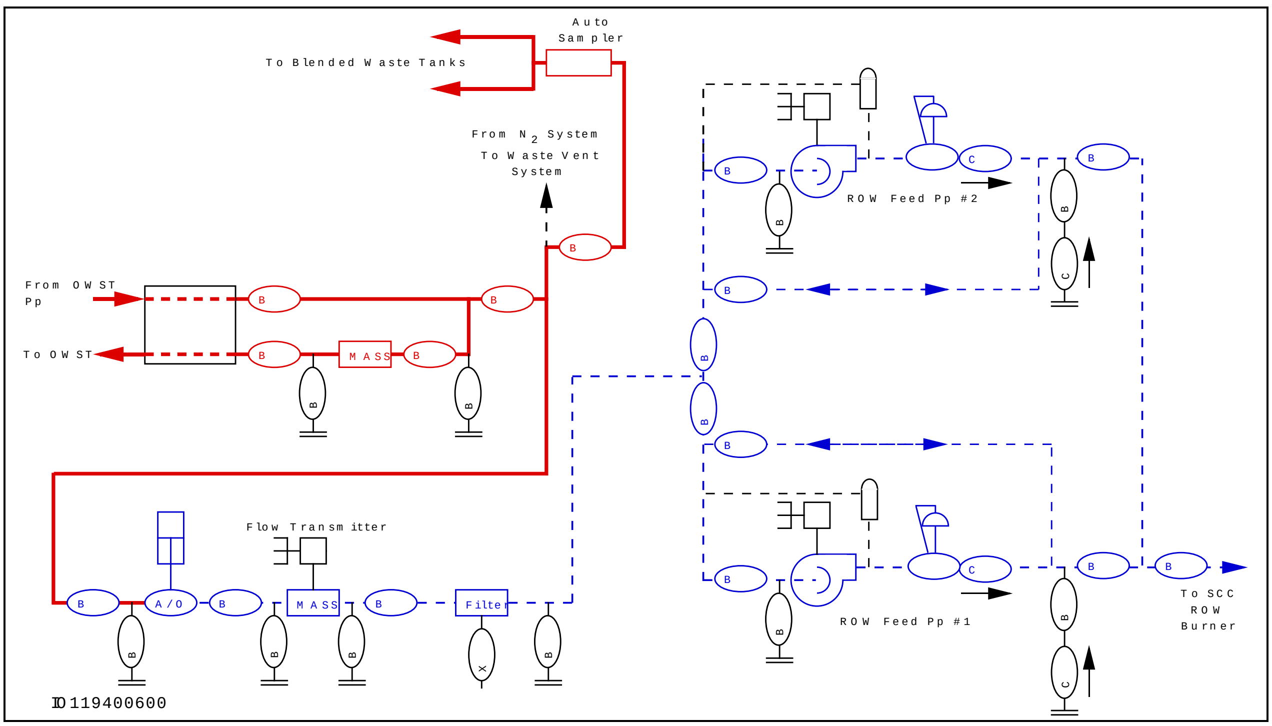

Figure 4 ROW System Sample Flowpath Diagram

Normal Flowpath

(See Figure 5, *ROW System Normal Flowpath, Feed Pp #1 Selected.*) The normal flowpath for the ROW System also originates in the OWST. The OWST Pump pumps ROW through the Transfer Line to the ROW Feed Pumps which provide the metered flow into the SCC ROW Burner. During normal operations, 95-98% of the flow in the system is recirculated back to the OWST through the recirculation flowpath with 2-5% of the ROW liquid flow fed to the SCC ROW Burner.

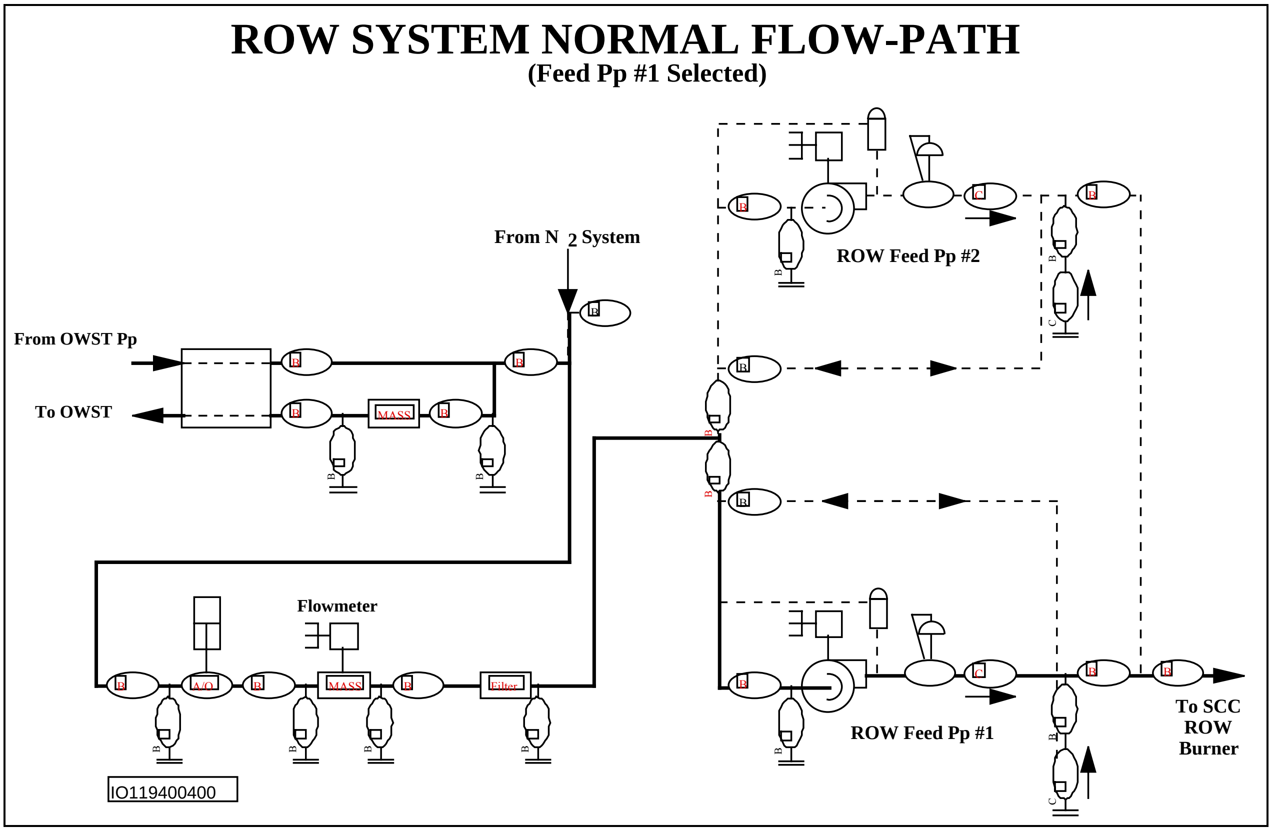

Figure 5 ROW System Normal Flowpath Feed Pp #1 Selected

Summary

- The ROW System consists of the Transfer Line between the DWPF and the CIF, two ROW Feed Pumps, the SCC ROW Burner (with local and remote burner skids), and the Leak Detection Monitor.
- Primarily, recirculation prevents settling of any particulate in the piping which would occur if the only flow established was that provided to the ROW Feed Pumps. The amount of flow provided for burner feed is very small, nominally 1/3 gpm.

- The ROW System sample flowpath utilizes the same flowpath as the recirculation flowpath with a small amount of flow directed through the Automatic Sampler to the selected Blend Tank.
- The OWST Pump pumps ROW through the Transfer Line to the ROW Feed Pumps which provide the metered flow into the SCC ROW Burner.

MAJOR COMPONENTS

ELO 3.01	**DESCRIBE the following major components of the ROW System including their functions, principles of operation, and basic construction:** **a. Organic Waste Storage Tank (OWST)** **b. OWST Pump** **c. ROW Transfer Line** **d. Leak Detection System** **e. ROW Feed Pumps** **f. SCC remote & local skids** **g. Secondary Combustion Chamber (SCC) ROW Burner**
ELO 3.02	**STATE the operational limitations for the following ROW System major components:** **a. ROW Feed Pumps** **b. Secondary Combustion Chamber (SCC) ROW Burner** **c. ROW Transfer Line**

The major components associated with the ROW System are the two ROW Feed Pumps, an SCC ROW Burner (with local and remote skids), the ROW Transfer Line Leak Detection Monitor, and associated piping and valves of the ROW Transfer Line. In addition to the ROW System components, a brief discussion of the OWST and the OWST Transfer Pump is provided below.

OWST

The OWST is a standard petroleum industry storage tank consisting of an inner and an outer tank. The tank has a capacity of 150,000 gallons. (See Figure 6, *Organic Waste Storage Tank.)*

The inner tank is constructed of stainless steel and is 35 feet in diameter, with a height of 24 feet 6 inches. The inner tank has a permanent fixed roof, and an inside floating roof. The floating roof inside of the inner tank floats on pontoons which rise and fall with level changes. A nitrogen blanket is maintained in the OWST, similar to the CIF nitrogen blanket system. A small vent is provided on the floating roof to equalize the pressure between the vapor spaces above and below the floating roof. The floating roof minimizes the exposed surface area of organic waste, thereby reducing benzene emissions to the atmosphere.

The inner tank is completely contained within an outer tank. The outer tank is constructed of carbon steel with a 42-foot diameter and a height of 23 feet 6 inches. The annulus between the inner and outer tank is equipped with a roof (to exclude rain water) and includes a leak detection system.

Foam injection nozzles are installed in both the inner and outer tanks for fire suppression. As shown on Figure 6, a 4-inch stainless steel overflow valve allows flow from the inner tank to the outer tank if the inner tank is overfilled (a highly unlikely condition).

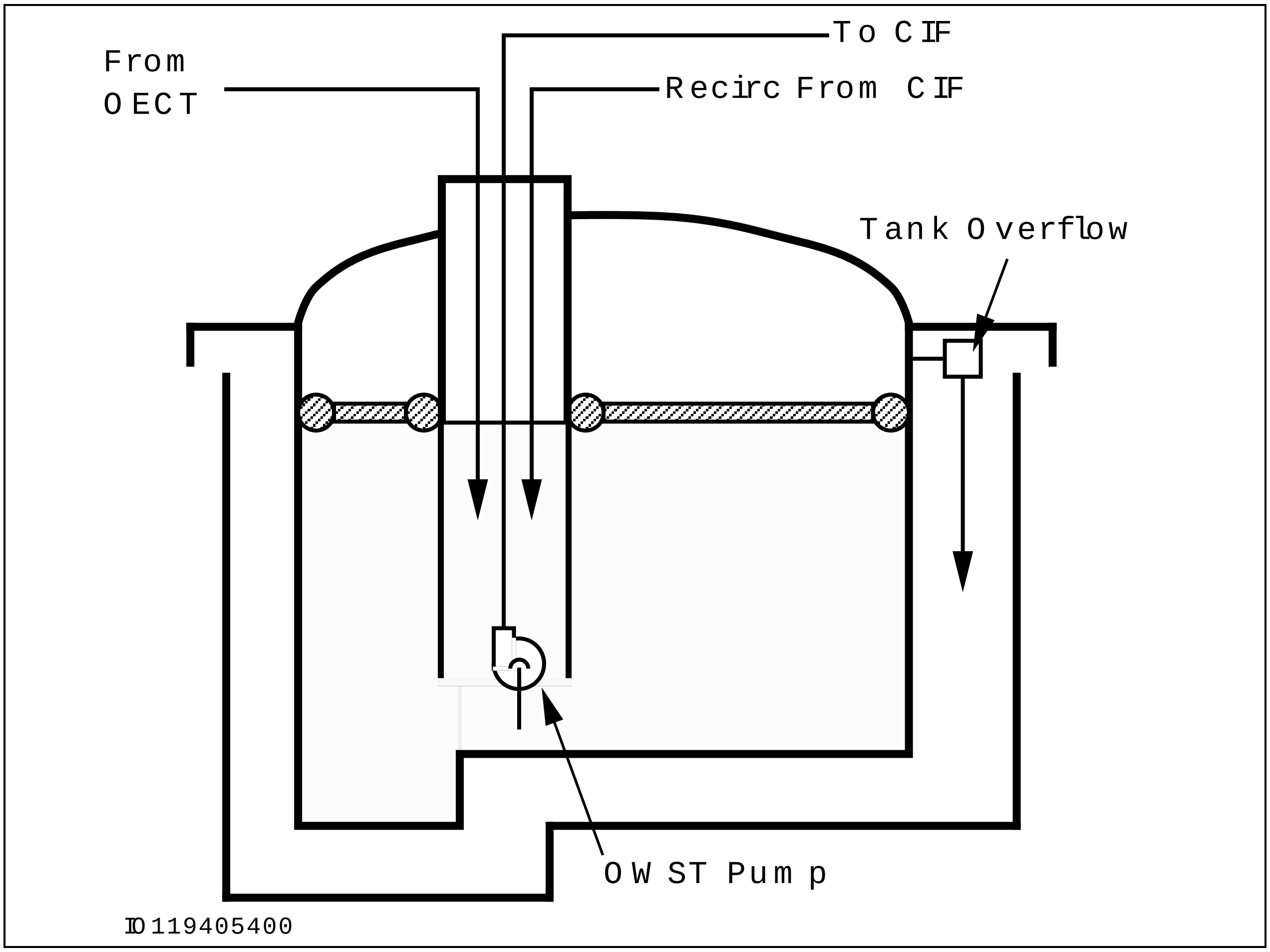

Figure 6 Organic Waste Storage Tank

OWST Pump

The OWST pump is a Red Jacket, 25 gpm, 2 HP, motor-driven, submersible pump. It is controlled locally at the OWST. The pump not only serves to transfer ROW to the CIF and to recirculate the OWST, it also can be used to sample the contents of the OWST.

ROW Transfer Line

(See Figure 7, *ROW System Transfer Line.*) The Transfer line consists of one feed and one return line enclosed in a protective shell. The line is electrically heat-traced and insulated. The transfer line from S Area to the diked area of the Tank Farm is approximately 1000 feet in length and consists of two 2-inch diameter carbon steel core lines contained within a single 10-inch carbon steel jacket. The ROW Transfer Line is depicted on Figure 7. This provides an enclosed circulation system between the OWST and the diked area of the Tank Farm.

The ROW Transfer line between the S-Area OWST and the CIF Tank Farm is sloped downward from the Tank Farm to the OWST. Once the OWST Pump is started, it takes approximately eight (8) minutes for the ROW liquid to reach the high point in the CIF Tank Farm.

A nitrogen blanket is regulated to feed this line so that pump discharge pressure will overcome it but when the pump is shutdown the nitrogen will fill the line as the liquid drains back to the OWST. A connection to the Waste Vent System is provided at the lines' high point in the Tank Farm, which uses HEPA filters and carbon canister to trap particulate and organic material prior to discharge to the Tank Farm stack. If liquid is sensed at the high point, a valve (0632HV) closes to prevent ROW from entering the Waste Vent System.

The following are operational limits/alarms for the ROW Transfer Line and leak detection system.

- H-261-ROW-TAL-0625, RAD ORGANIC TRANSFER LOW TEMPERATURE, DCS, 50.0 DEG F
- H-262-ROW-FAL-0617, RAD ORGANIC TRANSFER LOW FLOW, DCS, 20.0 GPM or (146.8) (LB/HR)
- H-262-ROW-FAL-0634, FV-0609 OUTLET, LOW FLOW, DCS, 0.60 GPM
- H-262-ROW-PAH-0624, RAD ORGANIC TRANSFER HIGH PRESSURE, DCS, 5.0 PSIG
- H-262-ROW-PAL-0624, RAD ORGANIC FROM OWST LOW, DCS, 1.0 PSIG
- H-261-ROW-CA-0900-(A), LEAK INDICATION DCS, ACTUATES

Leak Detection System

The core pipes and the jacket have welded joints to minimize leakage. A leak detection and location cable is installed on the inside bottom of the 10 inch jacket to detect any leakage from the core pipes. The electronic signals from the leak detection cable are automatically monitored by the DCS. If leaks occur, the operators will be alerted by an alarm. The location of the leak can be identified within approximately five feet by H-261-ROW-CA-0900-(A), "LEAK INDICATION DCS"

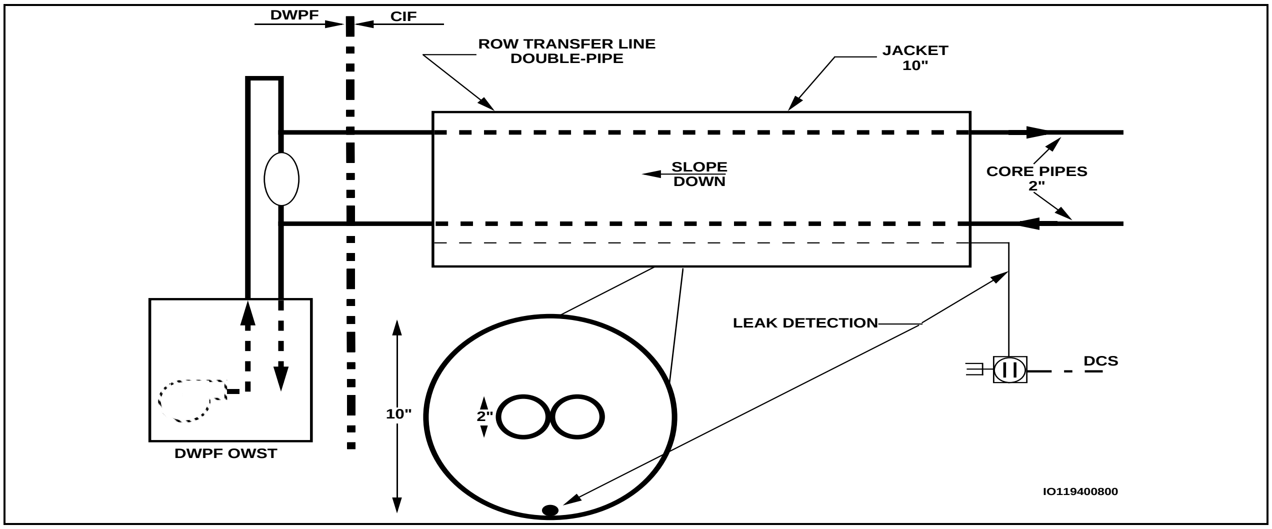

Figure 7 ROW System Transfer Line

ROW Feed Pumps

There are two (2) ROW Feed Pumps (P-0614-(A/B)). The Milton Roy HPD (High Performance Diaphragm) Metallic Liquid End Metering pumps are 3/4 hp, constant speed, variable stroke, positive displacement pumps. They are rated at 48 gph at a discharge pressure of 135 psig. Flow to the SCC ROW Burner is DCS controlled by adjustment of the pump stroke. Back Pressure Valves PV-0606 and PV-0607 are used to maintain a minimum back pressure of 40 psig on the discharge of the ROW Feed Pumps. The back pressure is needed to assist in stabilizing the flow from the ROW Feed Pumps and to provide metering accuracy.

The HPD Liquid End is particularly suitable for pumping costly, aggressive (caustic or acid) or other hazardous liquids without leakage. The diaphragm is hydraulically balanced between the process liquid on one side and the hydraulic oil on the other side. The hydraulic oil takes the place of a mechanical connection between the pump plunger and diaphragm.

(See Figure 8, *Tank Farm Layout*) The ROW Feed Pumps are located at the Tank Farm, near the Spare Tank, as shown on Figure 8. Power to ROW Feed Pumps No. 1 and No. 2 is supplied from Motor Control Center (MCC) 3.

There are several operational considerations for operating the feed pumps. The MOA switches should be placed in the "AUTO" position to ensure interlocks and permissives are not defeated. The feed pump stroke is controlled by the output of the DCS. ∑ Radioactive Organic Waste pump maximum discharge pressure is 150 psig as indicated on 0610PG and 0611PG at the feed pumps.

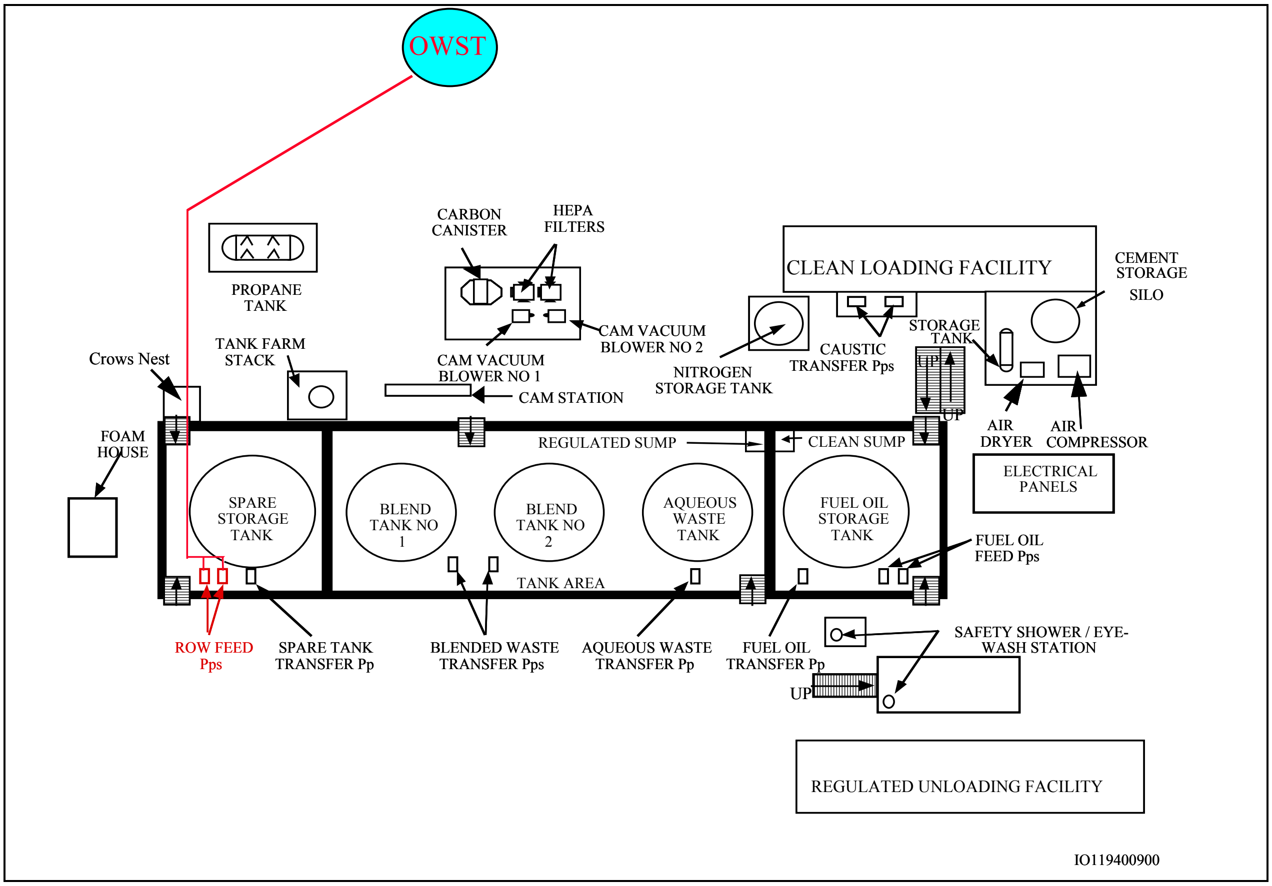

Figure 8 Tank Farm Layout

SCC ROW Burner Skids

It is important to understand the terms "local" and "remote" in reference to the SCC Burner. These terms have nothing to do with the physical location of the burner skids. "Local" indicates that the skid is the last group of components in the flowpath, prior to entry into the burner, usually containing the safety isolation or "shutoff" valves. "Remote" refers to the group of components prior to the "local" skid. It would be possible for a "remote" skid to be located physically closer to the burner than a "local" skid, however, in the piping run, the "Local" skid would be the last components prior to the burner. (See Figure 9, *SCC Local Burner Skid*)

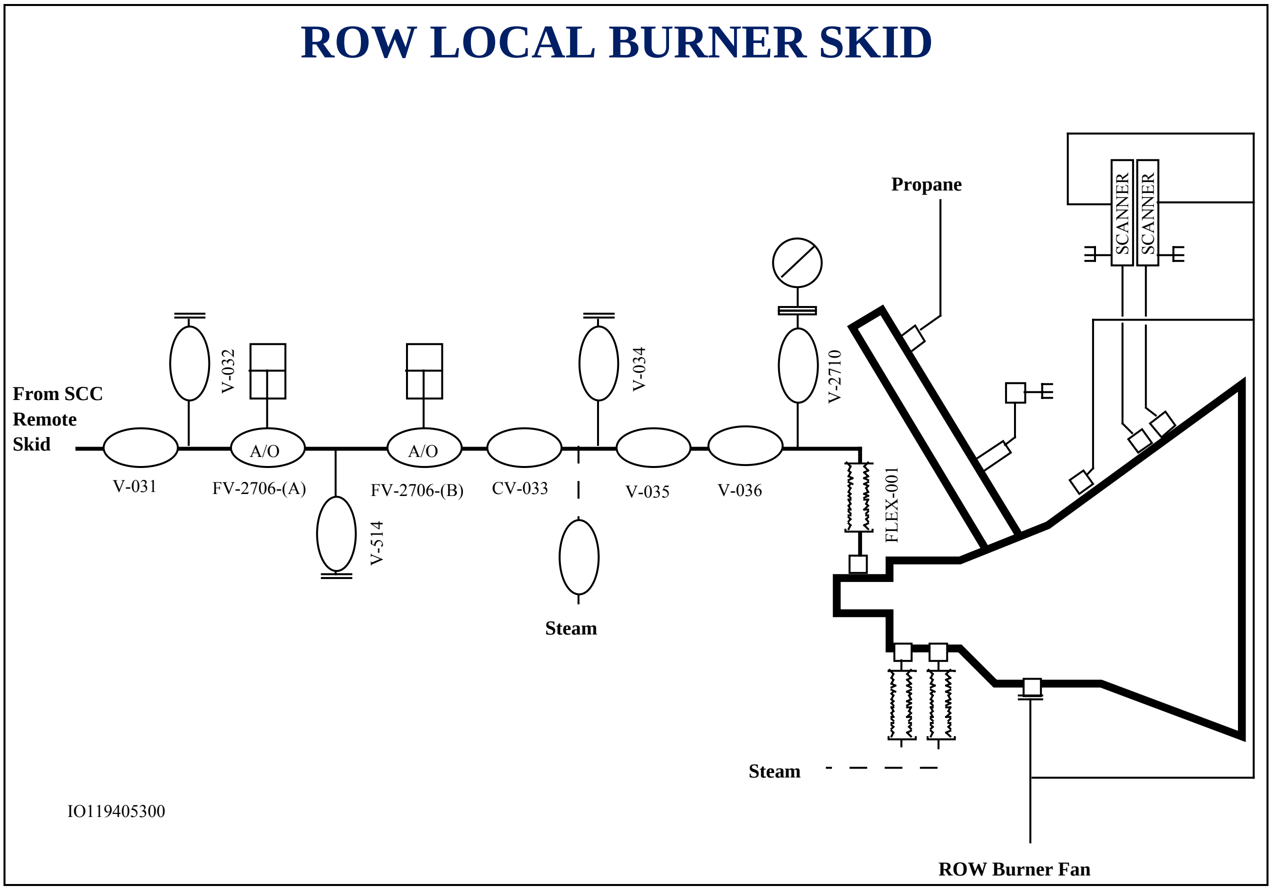

Figure 9 SCC Local Burner Skids

The flow of ROW is measured at the SCC Remote Burner Skid with a Coriolis mass flowmeter. The flowmeter sends a signal to a controller in the DCS. The DCS controller compares this flow signal to the setpoint and forced draft (FD) fan flow and adjusts the stroke of the ROW Feed Pump to meet the demand as required by the operator-inputted setpoint. The ROW Feed Lines are 1-inch carbon steel lines from the ROW Feed Pumps to the SCC ROW Local Burner Skid.

Pressure transmitters in the ROW liquid and steam lines send signals to the DCS. The DCS determines the pressure of the ROW liquid and adjusts the steam pressure to achieve the desired differential pressure. The ROW pressure at the burner will vary according to the flow rate, ranging from 90 psig at maximum flow rate of 210 lb/hr to 27 psig at the low flow rate of 55 lb/hr. These pressure transmitters are located on the SCC Remote Burner Skid. (See Figure 10, *SCC Remote Burner Skid*.)

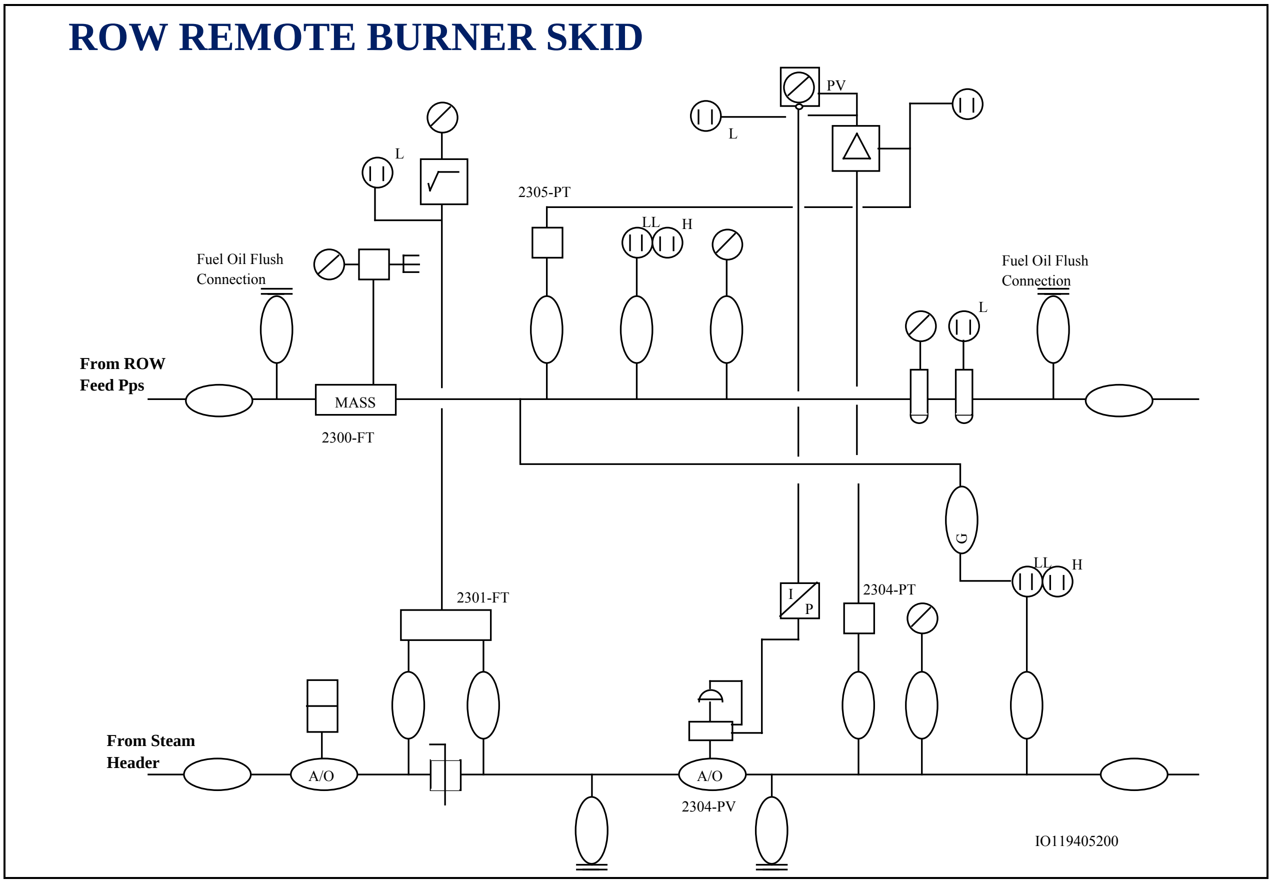

Figure 10 ROW Remote Burner Skid

SCC Rad Organic Waste (ROW) Burner

The SCC ROW Burner is a 3.8 x 10^6 BTU/hr short flame (2 feet to 9 inches), gun-type burner designed for modulating service and has a turndown ratio of 4:1. Turndown ratio is nothing more than the ability to decrease flow through the burner, from maximum to minimum, without the flame becoming unstable. In this case, the maximum design flow through the burner is 210 lb/hr with a minimum flow of 55 lb/hr. The ROW burner is limited to a flowrate of 191 lbm/hr by the DCS, based on permitting requirements. It will handle waste with a High Heating Value (HHV) in the range of 7,500 BTU/lb to 18,400 BTU/lb. Atomizing steam is used to provide burner cooling and the atomization of the ROW liquid. The ROW Feed Lines are reduced from 1" to 1/2" prior to the introduction of the atomizing steam.

A gun-type nozzle is provided to inject ROW into the SCC ROW Burner. As mentioned, steam is used as the atomizing force and is also used to maintain nozzle temperature within an acceptable range. Atomizing steam to the ROW Burner is controlled to approximately 30 psid above the ROW liquid firing pressure.

Summary

- The OWST is a standard petroleum industry storage tank consisting of an inner and an outer tank.
- The OWST pump is a Red Jacket, 25 gpm, 2 HP, motor-driven, submersible pump. It is controlled locally at the OWST. The pump not only serves to transfer ROW to the CIF and to recirculate the OWST, it also can be used to sample the contents of the OWST.
- The Transfer line has the following operational limits/alarms:
    1. H-261-ROW-TAL-0625, RAD ORGANIC TRANSFER LOW TEMPERATURE, DCS, 50.0 DEG F
    2. H-262-ROW-FAL-0617, RAD ORGANIC TRANSFER LOW FLOW, DCS, 20.0 GPM or (146.8) (LB/HR)
    3. H-262-ROW-FAL-0634, FV-0609 OUTLET, LOW FLOW, DCS, 0.60 GPM
    4. H-262-ROW-PAH-0624, RAD ORGANIC TRANSFER HIGH PRESSURE, DCS, 5.0 PSIG
    5. H-262-ROW-PAL-0624, RAD ORGANIC FROM OWST LOW, DCS, 1.0 PSIG
    6. H-261-ROW-CA-0900-(A), LEAK INDICATION DCS, ACTUATES
- There are two (2) ROW Feed Pumps. The Milton Roy HPD (High Performance Diaphragm) Metallic Liquid End Metering pumps are 3/4 hp, constant speed, variable stroke, positive displacement pumps. They are rated at 48 gph at a discharge pressure of 135 psig. There are several operational considerations for operating the feed pumps. The MOA switches should be placed in the “AUTO” position to ensure interlocks and permissives are not defeated. The feed pump stroke is controlled by the output of the DCS. Radioactive Organic Waste pump maximum discharge pressure is 135 psig as indicated on 0610PG and 0611PG at the feed pumps.
- The SCC ROW Burner is a 3.8 x 10^6 BTU/hr short flame (2 feet to 9 inches), gun-type burner designed for modulating service and has a turndown ratio of 4:1. Turndown ratio is nothing more than the ability to decrease flow through the burner, from maximum to minimum, without the flame becoming unstable. The ROW burner is limited to a flowrate of 191 lbm/hr by the DCS.
- In reference to the SCC Burner, "local" indicates that the skid is the last group of components in the flowpath, prior to entry into the burner, usually containing the safety isolation or "shutoff" valves. "Remote" refers to the group of components prior to the "local" skid, which monitors ROW pressure, flow, and temperature.

INSTRUMENTATION

ELO 3.03	**Given values for key performance indicators, DETERMINE if ROW System components are functioning as expected.**
ELO 3.04	**DESCRIBE the following ROW System instrumentation including, indicator location (local or Control Room) sensing points and associated instrument controls.** **a. SCC ROW steam flow** **b. SCC ROW steam pressure** **c. ROW feed flow** **d. ROW transfer flow** **e. ROW recirculation** **f. ROW temperature** **g. Leak detection**

SCC ROW Steam Flow

Steam flow to the SCC ROW Burner is measured by D-P flow transmitter H-261-MS-FT-2301 at the SCC remote skid. The transmitter sends a signal to the DCS. On the DCS, the indication is provided on Point Tag Display ROW2301F-1. This instrument supplies input to alarm H-261-MS-FAL-2301, SCC ROW LO STEAM FLOW and is set at 14 lb/hr. Additionally, this instrument supplies input to Interlock C173S, Atomizing Steam Permissive. Interlock C173s opens H-261-MS-FV-2311 to provide tip cooling for waste burners when RK and SCC reach 1000˚F, even if the burner is off and closes opens H-261-MS-FV-2311 when temperature falls below 1000˚F.

SCC ROW Steam Pressure

Steam pressure to the SCC ROW Burner is measured by pressure transmitter H-261-MS-PT-2304 at the SCC remote skid. The transmitter sends its signal to the DCS 2304-PT-1 where it is compared with a signal from the ROW liquid pressure (H-261-ROW-PT-2305). DCS Controller 2304-PC uses this signal to control steam valve H-261-MS-PCV-2304, which maintains the steam pressure 30 psi above the ROW liquid pressure. This instrument supplies input to the following alarms on DCS Point Tag Display ROW2304PC-1:

- LO SCC ROW STEAM D-P (H-261-MS-PAL-2304) at 20 psid
- LO LO SCC ROW PRESS (H-261-ROW-PALL-2303) at 20 psig
- LOW SCC ROW PRESS (H-261-ROW-PAL-2305) at 25 psig

ROW Feed Flow

The ROW feed flow is measured on the SCC Remote Burner Skid by a Coriolis mass flowmeter, H-261-ROW-FT-2300. The flowmeter transmits a signal to the DCS for ROW Feed Pump speed control, and input to H-261-FD-FC-2707 for combustion air control. DCS indication of ROW feed flow is provided on 2300FG. An alarm associated with this instrument is located on Point Tag Display ROW2300FC-1, SCC ROW HI FLOW (H-261-ROW-FAH-2300), which is set at 191 lb/hr. The instrument also provides input for the following interlocks:

- C205, SCC FLOW RATE HIGH (Waste Feed Cutoff)
- C219, SCC RAD ORGANIC LOADING

ROW Transfer Flow

The ROW Transfer Flow is measured by a Coriolis mass-type flowmeter at the tank farm diked area, near the Spare Tank and ROW Feed Pumps. The flowmeter, H-262-ROW-FT-0634, measures ROW flow to the suction of the ROW Feed Pumps and sends a signal to the DCS for indication, totalization, alarms, and interlocks. Indication is provided on DCS Point Tag Display ROW0634F-1 which is equipped with LOW OWST XFER FLOW (H-262-ROW-FAL-0634) alarm (set at 4.4 lb/min). In addition the signal inputs to the following interlocks:

- A45, OWST TRANSFER VALVE 0609
- A65, OWST TRANSFER PRESS HI
- A66, OWST TRANSFER TEMP LO

ROW Recirculation Flow

OWST return flow is also measured by Coriolis mass-type flowmeter at the tank farm “crows nest”, H-262-ROW-FE-0617. This instrument measures the ROW return flow (recirculation) to the OWST. The signal from this instrument provides input to the DCS on Point Tag Display ROW0617F-1, which provides alarm LOW OWST RECIRC FLOW (H-262-ROW-FAL-0617) set at 146 lbm/min (20 gpm). In addition, the signal inputs to the following interlocks:

- A97, RAD ORGANIC VENT LINE LIQUID
- A98, RAD ORGANIC VENT VALVE
- A99, ROW RECIRC FLOW LO
- A103, OWST TRANSFER PRESSURE LOW

ROW Temperature

ROW feed temperature is monitored at the SCC remote skid by H-261-ROW-TSL-2309, which sends a alarm signal to the DCS. ROW transfer temperature is monitored at the tank farm by H-261-ROW-TSL-0625, which sends a signal to DCS for a low temperature alarm.

Summary

- Steam flow to the SCC ROW Burner is measured by D-P flow transmitter H-261-MS-FT-2301. The transmitter sends a signal to the DCS.

- DCS Controller H-261-MS-PT-2304 uses SCC ROW Burner steam signal to control steam valve H-261-MS-PCV-2304, which maintains the steam pressure 30 psi above the ROW liquid pressure.
- The ROW feed flow is measured on the SCC Remote Burner Skid by mass flowmeter H-261-ROW-FT-2300. Maximum ROW feed flow is controlled at 191 lbm/hr. The flowmeter transmits a signal to the DCS for ROW Feed Pump speed control, and input to H-261-FD-FC-2707 for combustion air control.
- The ROW Transfer Flowmeter, H-262-ROW-FT-0634, measures ROW flow to the suction of the ROW Feed Pumps and sends a signal to the DCS for indication, totalization, alarms, and interlocks.
- OWST return flow is also measured by a mass-type flowmeter H-262-ROW-FE-0617. This instrument measures the ROW return flow (recirculation) to the OWST.
- ROW temperature is monitored at the SCC remote skid and at the ROW Transfer Line as it enters the CIF tank farm.

CONTROLS, INTERLOCKS AND ALARMS

ELO 3.05	**INTERPRET the following ROW System alarms, including the conditions causing alarm actuation and the basis for the alarms:** **a. SCC ROW steam flow** **b. SCC ROW steam pressure** **c. ROW feed flow** **d. ROW feed pressure** **e. ROW recirculation** **f. ROW temperature** **g. Leak detection**

Setpoints

(See Table 2, *Rad Organic Waste Setpoints.)*

DRAWING NUMBER	CLI NUMBER	ALARM	SET-POINT	UNITS
W2017829	H-261-ROW-TAL-0625	RAD ORGANIC TRANSFER LOW TEMPERATURE, DCS	50.0	DEG F
W2017829	H-262-ROW-FAL-0617	RAD ORGANIC TRANSFER LOW FLOW, DCS	20.0 (146.8)	GPM (LB/HR)
W2017829	H-262-ROW-FAL-0634	FV-0609 OUTLET, LOW FLOW, DCS	0.60	GPM
W2017829	H-262-ROW-PAH-0624	RAD ORGANIC TRANSFER HIGH PRESSURE, DCS	5.0	PSIG
W2017829	H-262-ROW-PAL-0624	RAD ORGANIC FROM OWST LOW, DCS	1.0	PSIG
W2017829	H-262-ROW-PDAH-0613	ROW-FLT-001 HIGH D/P, DCS	3.0	PSID
W2022341	H-262-ROW-CA-0900-(B)	INDICATION OWST LOCAL LEAK	ACTUATES	NA
W2022341	H-261-ROW-CA-0900-(A)	LEAK INDICATION DCS	ACTUATES	NA
W2022341	H-261-ROW-LAL-0901	OWST LOW LEVEL, S-AREA DCS	25-30% Set by S-Area	GAL
W836368	H-261-MS-FAL-2301	MAIN STEAM LOW FLOW, DCS	14.0	LB/HR
W836368	H-261-MS-PAH-2307	MAIN STEAM HIGH PRESSURE, DCS	40.0	PSID
W836368	H-261-MS-PAH-2310	MAIN STEAM HIGH PRESSURE, DCS	110.0	PSIG
W836368	H-261-MS-PAL-2304	BNR-004 ATOMIZING STEAM LOW PRESSURE, DCS	20.0	PSID

Table 2 Rad Organic Waste Setpoints

DRAWING NUMBER	CLI NUMBER	ALARM	SET-POINT	UNITS
W836368	H-261-MS-PAL-2310	MAIN STEAM LOW PRESSURE, DCS	25.0	PSIG
W836368	H-261-MS-PALL-2307	MAIN STEAM LOW-LOW PRESSURE, DCS	20.0	PSID
W836368	H-261-ROW-FAH-2300	BRN-004 HIGH FLOW, DCS	191.0	LB/HR
W836368	H-261-ROW-PAH-2303	BNR-004 HIGH PRESSURE, DCS	95.0	PSIG
W836368	H-261-ROW-PAL-2305	SCC RAD ORGANIC WASTE LOW PRESSURE, DCS	25.0	PSIG
W836368	H-261-ROW-PALL-2303	BNR-004 LOW-LOW PRESSURE, DCS	18.0	PSIG
W836368	H-261-ROW-TAL-2309	RAD ORGANIC WASTE LOW TEMPERATURE, DCS	10 (being revised to 45)	DEG F
W836369	H-261-FD-FAL-2700	SCC RAD ORGANIC AIR FLOW, DCS	950	LB/HR
W836369	H-261-FD-FALL-2700	LOW-LOW SCC RAD ORGANIC AIR FLOW, DCS	844	LB/HR
W836369	H-261-INC-BAL-2715	FLAME BURNER, LOW BNR-004 DCS	FLAME OFF	VOLT
W836369	H-261-INC-BAL-2716	FLAME BURNER, LOW, BNR-004 DCS	FLAME OFF	VOLT
W836369	H-261-INC-ZA-2720	BNR-004 POSITION, DCS	ACTUATE	NA

Table 2 Rad Organic Waste Setpoints (cont.)

SCC ROW Steam Flow & Pressure

ROW steam pressure and flow are controlled to ensure proper atomization steam is present for efficient incineration of ROW and adequate cooling of burner nozzles. Alarms are provided to alert process operators of abnormal situations involving ROW steam pressure and flow. A loss of supply steam or a failure of steam control valves (2304PV or 2311HV) to function properly.

ROW Feed Flow & Pressure

ROW feed flow and pressure are monitored to ensure proper operation of the ROW feed to the SCC, and to ensure waste feed limits are not exceeded. Alarms are provided to alert process operators of high or low flow and pressure conditions. A failure of the ROW Feed Pumps or their DCS controls, could lead to these abnormal conditions. A failure of the ROW flow controller (2300FC) could also cause abnormal conditions.

ROW Recirculation

ROW transfer flow is monitored at the CIF as it begins to return to the OWST. Transfer flow is monitored to ensure proper operation of the ROW Transfer System. A minimum flow of 20 gpm is required at all times during recirculation or transfer. Maintaining return flow to the OWST at greater than 20 gpm will help keep solids suspended in solution.

ROW Temperature

ROW temperature is monitored and controlled to maintain the transfer line above the freezing point of benzene. The transfer line is double-piped, electrically heat traced, and insulated to maintain a minimum temperature of 47 °F which is 5 °F above the freezing point of benzene. Conditions which could affect the ROW temperature are a failure of the heat trace or insulation on the ROW Transfer Line.

Leak Detection

The purpose of leak detection alarms are to notify process operators of leaks in the ROW Transfer Line. This is to ensure the prompt shutdown of the ROW System to mitigate the leak and minimize the amount of ROW leaked to the environment. Personnel exposure to benzene is a health hazard. Proper protective measures are required when working with benzene cleanup. Industrial Hygiene will determine the proper protective measures to be taken by individuals.

ELO 3.06	**EXPLAIN how the following ROW System equipment is controlled in all operating modes or conditions to include control locations (local or Control Room), basic operating principles of control devices, and the effects of each control on the component operation:** **a. ROW Feed Pumps** **b. ROW System nitrogen purge valve 0628HV** **c. ROW transfer valve 0609HV**
ELO 3.07	**DESCRIBE the interlocks associated with the following ROW System equipment to include the interlock actuating conditions, effects of interlock actuation, and the reason the interlock is necessary:** **a. ROW purge valve 0628HV** **b. ROW transfer valve 0609HV**

Controls

The ROW Feed Pumps and associated ON/OFF valves are controlled via the DCS. There are no local controls associated with the ROW System, although the ROW Pumps will have local control switches for testing purposes. ROW feed pump stroke is controlled from DCS inputs whenever ROW feed is initiated during Mode 1 operations.

Nitrogen purge and venting of the ROW Transfer Line is controlled from the DCS automatically as a function of logic during normal startup and shutdown sequence of operations.

NOTE: A design request has been submitted to provide emergency shutoff capability for the OWST Pump from the CIF Control Room, but this design change has not been installed at present time.

Interlocks

ROW Transfer Valve H-262-ROW-FV-0609

This interlock ensures that ROW system parameters are normal prior to initiating feed to the SCC. The logic associated with ROW Transfer Valve H-262-ROW-FV-0609 is depicted on CIF Tank Farm Logic Diagram, Sheet 3 *Instruments*, SE5-2-2006177. The ROW Transfer Valve Interlock prevents the valve from opening, unless the following conditions are all met:

- ROW Transfer Pressure not high, > 5 psig (H-262-ROW-PAH-0624) (2 signals)
- ROW Recirc Flow not low, < 20 gpm (H-262-ROW-FSL-0617)
- ROW Transfer Temperature not low (H-262-ROW-TSL-0625)
- ROW Nitrogen Purge Valve closed (H-262-LN-FV-0628)
- ROW Feed Pp Start Pushbutton depressed (H-262-ROW-HS-0614-(B))

ROW Nitrogen Purge Valve H-262-LN-FV-0628

The logic associated with ROW Nitrogen Purge Valve H-262-LN-FV-0628 is depicted on CIF Tank Farm Logic Diagram, Sheet 3 *Instruments*, SE5-2-2006177. The ROW Nitrogen Purge Valve Interlock prevents the valve from opening unless the following conditions are all met:

- ROW Transfer Pressure >1 psig (H-262-ROW-PSH-0624)
- ROW Transfer Valve closed (H-262-ROW-ZS-0609-(B))
- ROW Vent Valve to HEPA Filters closed (H-262-WV-FV-0632) (See Information Only)
- ROW Feed Pump No. 1 not running (MCC seal in 520-03)
- ROW Feed Pump No. 2 not running (MCC seal in 520-04)

(Information Only - A DCF has been submitted that will vent the ROW Transfer Line nitrogen purge volume back to the OWST, instead of through the Tank Farm Vent System. This design change will prolong the life of the Tank Farm carbon canisters significantly, and have no adverse effects on the OWST.)

ROW Vent Valve H-262-WV-FV-0632

The logic associated with ROW Vent Valve H-262-WV-FV-0632 is depicted on CIF Tank Farm Logic Diagram, Sheet 3 *Instruments*, SE5-2-2006177. The ROW Vent Valve Interlock prevents the opening of the valve (or will close the valve), unless the following conditions are all met:

- ROW Transfer Pressure <5.0 psig (H-262-ROW-PSH-0624) and ROW Nitrogen Purge Valve (H-262-LN-FV-0628) closed and OWST Transfer Pump Start Pushbutton has been depressed (H-262-ROW-HS-0614-(B)). After these conditions are met, the vent valve will open for 11 minutes and then close.
- No liquid detected in the ROW Vent Line (H-262-WV-FS-0631)
- (Information Only- the purposed DCF for the ROW nitrogen venting will affect the ROW Vent Valve H-262-WV-FV-0632, logic diagram, that is shown below.)

ROW Feed Pumps P-0614-(A/B)

The logic associated with the operation of the ROW Feed Pumps is shown on CIF Tank Farm Logic Diagram Sheet 9 Instruments, SE5-2-2006183. There are a significant number of conditions that must exist for the ROW Feed Pumps to be started or to remain running.

- Row Feed Pump Start Push-Button (H-262-ROW-HS-0614-(B))
- ROW Feed Pump No. 1 Field Start Pushbutton
- MCC seal in for Row Feed Pump No. 1
- ROW Feed Pump selector switch (H-262-ROW-HS-0614-(A)), Feed Pump No. 1 selected
- ROW Transfer Pressure (H-262-ROW-PS-0624)
- Row Feed Pump Stop Pushbutton (H-262-ROW-HS-0614-(B))
- ROW Recirculation Flow (H-262-ROW-FSL-0617)
- ROW Nitrogen Purge Valve H-262-LN-ZI-0628-(A/B) position
- ROW Transfer Temperature (H-262-ROW-TSL-0625)
- ROW Transfer Valve H-262-ROW-ZI-0609-(A/B) position
- Incinerator Control Signal from the Burner Management System (BMS)
- Combustible Gas Detectors in the Tank Farm (6800XS-1 thru 7)
- Combustible Gas Detector in Tank Farm Stack (6800XS-8)
- Combustible Gas Detector in Incinerator (6801XS-1 thru 5)
- S-Area "Ready To Feed" Signal
- ROW Feed Pump selector switch (H-262-ROW-HS-0614-(A)), Feed Pump No. 2 selected
- ROW Feed Pump No. 2 Field Start Pushbutton (H-262-ROW-HS-0614-(B))
- SCC seal in for Row Feed Pump No. 2

Limits

Limitations associated with the ROW System or ROW operations in the CIF are as follows:

- SCC exit gas temperature must be maintained at >1650 °F to ensure complete combustion of materials.
- Atomizing steam valve must be open above 1000 °F to maintain nozzle temperature within design limits.
- Max. ROW flow rate: 191 lb/hr @ 90 psig
- Min. ROW flow rate: 55 lb/hr @ 27 psig
- Max. High Heat Value: 18,400 Btu/lb
- Max. allowable refractory temperature: 2800 °F
- Max. internal pressure rating for Rotary Kiln & SCC: 10 psig (Note - The RK & SCC will be operated at a negative pressure and shutdown at -0.01 inwc.)
- Max. flow rate of No. 2 Fuel Oil to the SCC: 462 lb/hr
- Max. High Heat Value of No. 2 Fuel Oil to the SCC: 19,200 BTU/hr
- Min. ROW Transfer Pipe Temperature: 47 °F (alarm at 50 °F) based on freezing point of Benzene, which is 42 °F.

Summary

- The ROW Feed Pumps and associated ON/OFF valves are controlled via the DCS. There are no local controls associated with the ROW System, although the ROW Pumps will have local control switches for testing purposes.
- Interlocks are used to prevent operation of critical equipment or components, unless required conditions are met/satisfied.
- Limits are used to keep components operating within a safe range, thus ensuring safe operation of the ROW System.

SYSTEM INTERRELATIONS

ELO 2.03	**Given a description of the ROW System equipment status, IDENTIFY conditions which interfere with normal system flowpaths.**
ELO 2.04	**Given a description of abnormal equipment status for the ROW System, EXPLAIN the significance of the condition on system operation.**

DCS

The DCS controls most aspects of the ROW System. It monitors electronic signals from the Leak Detection Cable to determine if a leak has occurred. If a leak is sensed, the DCS will initiate an alarm. This condition would require a shutdown of the SCC ROW burner.

For the SCC ROW Burner, the DCS receives pressure signals from ROW liquid and steam line pressure transmitters and adjusts the atomizing steam pressure to maintain 30 psid between the ROW pressure and the atomizing steam pressure.

The DCS receives a flow signal from the mass flowmeter for flow from the ROW Feed Pumps. It compares the signal with the setpoint established by the operator and the Forced Draft (FD) fan air flow, and then adjusts the stroke of the ROW Feed Pump accordingly.

Tank Farm Automatic Sampler

The Automatic Sampler receives flow from many possible locations, one of which is the ROW System, as indicated on Figure 11, *Tank Farm Automatic Sampler*. The discharge of the sampler is then directed to one of the Blend Tanks as designated by the chemistry coordinator. The Automatic Sampler is discussed in detail in the lesson on the CIF Tank Farm Automatic Sampler.

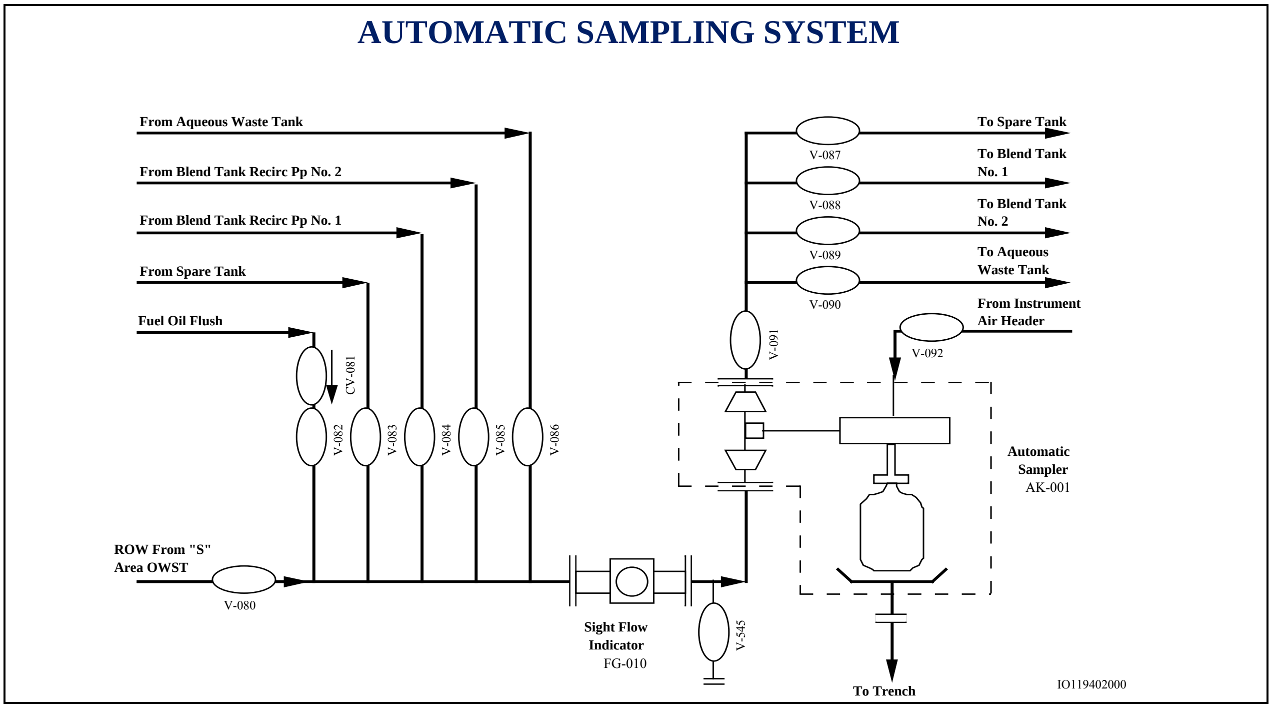

Figure 11 Tank Farm Automatic Sampler

Blended Waste System

Figure 12, *Automatic Sampler Flowpath*, shows the discharge of the Automatic Sampler directed to one of the Blended Waste Tanks. Either tank may be aligned to receive ROW.

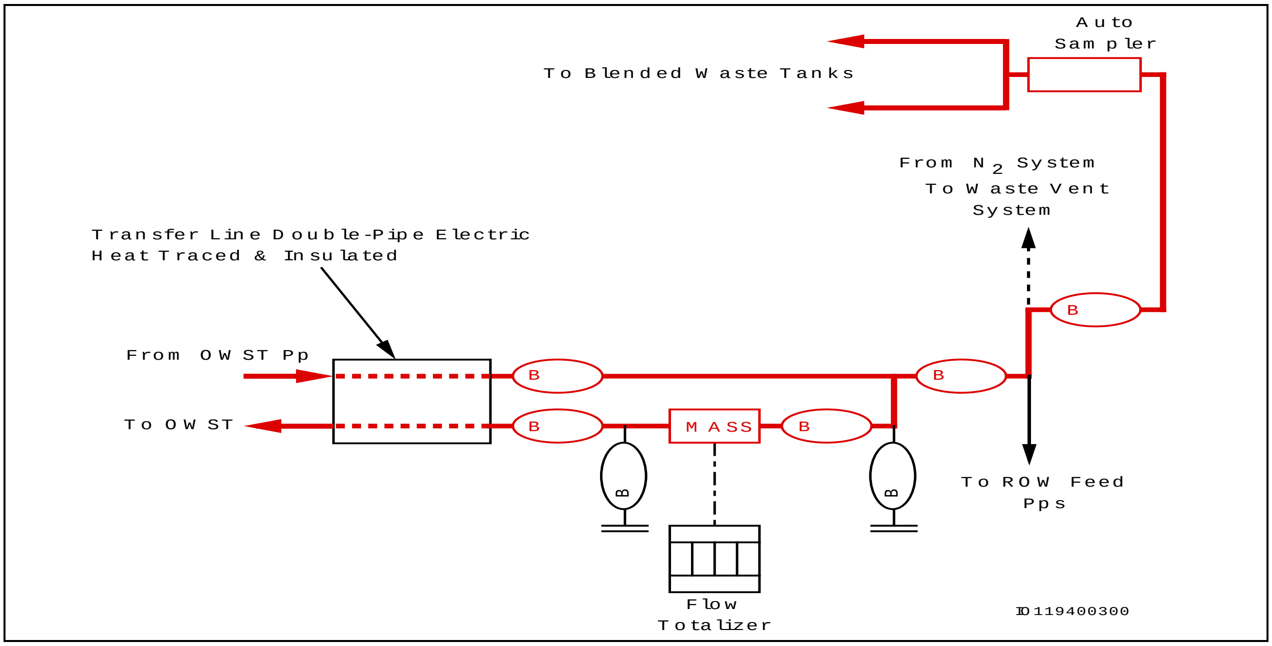

Figure 12 Automatic Sampler Flow-Path

Steam System

The Steam System supplies Atomizing Steam to the SCC ROW Burner. This steam provides cooling for the burner nozzle and atomizes the ROW Liquid for efficient combustion. A loss of ROW steam will initiate a automatic shutdown of the ROW burner. Steam can also be directed to flush the line into the burner. Steam System connections are depicted on Figure 10.

Nitrogen System

The Nitrogen System provides a purge in the ROW Transfer Line when ROW is not being pumped through the system (see Figure 1). The purge is necessary to ensure that there is no oxygen buildup to mix with Benzene vapors, forming an explosive mixture. It is important to have a nitrogen purge on the ROW Transfer Line from a safety aspect, but nitrogen is not required once ROW feed has been initiated to the SCC. Remember, other tank farm systems may require that the carbon canister and HEPA filters be on line, even if the ROW System does not.

The nitrogen pressure is regulated at approximately 0.05 inches of water column (inwc). When the OWST Pump is turned off, the liquid drains back to the OWST, and the nitrogen refills the line. A nitrogen block valve opens to admit nitrogen to the system.

Nitrogen is also supplied above the diaphragm in the pulsation dampers located on the discharge of the ROW Feed Pumps (see Figure 1).

Waste Vent System

A connection to the Waste Vent System is provided at the High Point of the ROW Transfer Line in the Tank Farm. This vent directs gases from the system into the HEPA Filters and Carbon Canister of the Waste Vent System prior to release through the Tank Farm Stack. The vent valve opens (WV-FV-0632) when the OWST Pump is started to allow the nitrogen to be vented from the system. This is accomplished by the pressure in the system causing PSV-003 (H-262-ROW-VLR-001) to open. A liquid sensor is provided in the vent system to close the vent valve in the event that liquid is sensed in the pipe. Figure 13 shows the interface between the ROW System and the Waste Vent System. The Waste Vent System carbon canister and HEPA filters are required to be on line for a ROW System startup. Once the ROW feed is in progress, the carbon canister and HEPA filters are not required to be on line. Remember, other tank farm systems may require that the carbon canister and HEPA filters be on line, even if the ROW System does not.

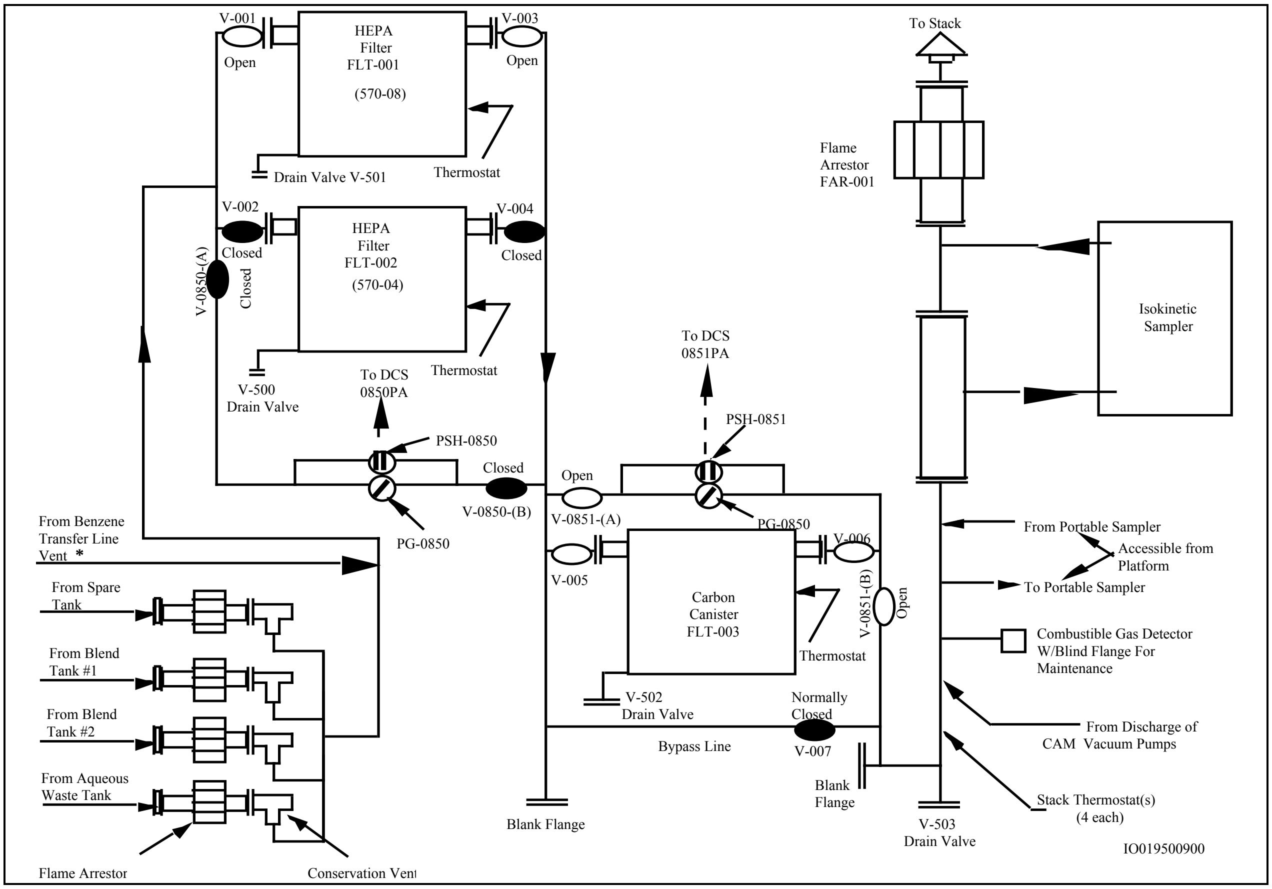

Figure 13 Row System Interfaces

Summary

- The DCS controls most aspects of the ROW System. It monitors electronic signals from the Leak Detection Cable to determine if a leak has occurred. If a leak is sensed, the DCS will initiate an alarm.
- The Automatic Sampler receives flow from many possible locations, one of which is the ROW System. The discharge of the sampler is then directed to one of the Blend Tanks.
- The Steam System supplies Atomizing Steam to the SCC ROW Burner. This steam provides cooling for the burner nozzle and atomizes the ROW Liquid for efficient combustion.
- The Nitrogen System provides a purge in the ROW Transfer Line when ROW is not being pumped through the system. The purge is necessary to ensure that there is no oxygen buildup to mix with Benzene vapors, forming an explosive mixture.
- A connection to the Waste Vent System is provided at the High Point of the ROW Transfer Line in the Tank Farm. This vent directs gases from the system into the HEPA Filters and Carbon Canister of the Waste Vent System prior to release through the Tank Farm Stack.

INTEGRATED PLANT OPERATIONS

ELO 4.01 Given applicable procedures and plant conditions, DETERMINE the actions necessary to perform the following ROW System operations:

a. Startup

b. Manual Operation of Equipment

c. Shutdown

ELO 4.02 DETERMINE the effects on the ROW System and the integrated plant response when given any of the following:

a. Indications/alarms

b. Malfunctions/failure of components

c. Operator Actions

Normal Operations

The ROW System is operated per procedure SOP-ROW-01, *RAD ORGANIC WASTE*. Entry to this procedure may be directed from General Operating Procedures (GOPs), Alarm Response Procedures (ARPs), Abnormal Operating Procedures (AOPs), or Emergency Operating Procedures (EOPs).

System Startup

Prerequisites for system startup require that communications be established between the CIF and DWPF Operations personnel. In addition, the following procedures must be performed to ensure that the required support of the associated systems is available prior to ROW System startup: 1) Procedure SOP-WV-01, *WASTE VENT* , places the Nitrogen Vent System in service to the ROW transfer line. 2) Procedure SOP-NS-01, *LIQUID NITROGEN SUPPLY*, places the Nitrogen Purge System in service to the ROW Transfer Line. 3) Procedure SOP-HTTR-01, *HEAT TRACING*, places the ROW Transfer Line heat trace in service.

After the prerequisites have been met, the ROW System is aligned in accordance with the SOP and the ROW Transfer Line verified >55 °F. ROW recirculation is initiated by the Defense Waste Processing Facility (DWPF) Control Room Operator (CRO) who controls the OWST Pump. It should be noted that once the OWST pump has been started, it will take about eight (8) minutes to fill the ROW Transfer Line.

A ROW Sample must be obtained prior to initiating ROW feed. In order to take a sample, ROW recirculation flow must be >4.34 lb/min with the ROW System recirculating for at least 20 minutes. The Chemistry Coordinator (CC) determines which Blend Tank will be lined up to receive the discharge of the Automatic Sampler. The CC samples the Blend Tanks to ensure compatibility with the ROW. If the contents of a tank are not compatible with the ROW, and ROW is admitted to the tank from the discharge of the Automatic Sampler, it is possible for an exothermic reaction to occur which could result in overheating, fire, or an explosion. The potential for this reaction makes it extremely important that the sampler be aligned to the correct tank. Figure 12 shows the possible flowpaths of the Automatic Sampler. Upon completion of the sample of the ROW, the valves are realigned to permit ROW feed. The Benzene flow to the Autosampler and back to the Blended Waste Tank(s) is estimated to be 15 gallons per minute (gpm). The ROW sample should be drawn as quickly as possible, and not permitted to recirculate to the Blended Waste Tank(s) any longer than necessary. This will minimize the buildup of ROW in the Blended Waste Tank(s).

Once it has been determined that the ROW sample results are acceptable for feed operations, ROW feed can be established. Once the SCC and RK "READY FOR WASTE" permissives are actuated, a ROW Feed Pump may be selected as the lead pump. (These permissives will be addressed in the Module on the Incinerator, ZIOITX25.) Zero Pump Stroke is selected on the ROW Flow Controller, and the SCC ROW Steam Pressure Controller is set to 28 psid. SCC-ROW START is then actuated.

Once SCC-ROW START has been actuated, the ROW Burner FD Fan and ROW Feed Pump should indicate “running” on the DCS, and the "FLAME FAIL" alarms for Scanners 2715X and 2715XA should be extinguished. ROW Feed Pump stroke is increased from zero to the Low Fire Position by the operator. This results in the ROW Feed Valves opening and illuminating the “SCC RO ON” light. From this point, the ROW Feed Pump stroke is adjusted by the Operator as necessary to establish the desired flow rate.

DCS Mode 1 - Operations

During Mode 1 operations, the Fuel Oil Burner in the SCC is maintained on the Low Fire setting unless required to maintain desired temperature. This is possible due to the BTU addition of the ROW being burned. Normally, the ROW Burner will be operated at a fixed flow rate of 100 lb/hr average. The Tertiary Air Fan will be operated to prevent temperature overrun or excess CO (Carbon Monoxide) in exit gas.

Normal Operating Parameters

The ROW Feed Stroke is adjusted as necessary to establish or maintain the desired flow rate. The following are the normal parameters for the ROW System:

- ROW pressure from OWST: ~10 psig (0637PG)
- ROW flow from OWST: ~5 lb/min (H-262-ROW-FI-0634-(B))
- ROW Pump max. discharge pressure: <150 psig (H-262-ROW-PI-0610 and H-262-ROW-PI-0611)
- ROW mass flow: 55-191 lb/hr (2300FG)
- ROW pressure: 1-140 psig (2302PG)
- ROW temperature: >47 °F
- ROW Burner pressure: 27-90 psig (2719PG)
- ROW Burner steam pressure: 62-102 psig (30 psi greater than ROW Burner pressure) (2718PG)
- Steam supply pressure: 100-135 psig (H-261-MS-PI-2306)

DCS Mode 2 - Warm Standby and DCS Mode 3 - Cold Standby

During Mode 2 and 3 operations, applicable ROW system parameters are monitored as in Mode 1. When ready to return to Mode 1 operations, ROW recirculation is initiated by the DWPF CRO who controls the OWST Pump.

Routine Inspections

Operator rounds are controlled and documented in CIF procedures. The items listed below are general statements of items that can be found in these procedures.

1. Inspections of valves, seals, pumps and agitators in the ROW System will be performed in accordance with 261-SUR-FE-01, Fugitive Emissions Quarterly Inspection (U).

2. Rad Organic Feed Pumps shall be inspected for leaks and pump discharge pressure will be verified during pump operation as a part of shift rounds which are found in Tank Farm Operator Rounds, 261-TFOR-01.

3. Inside Operator Rounds, 262-IOR-01, will verify for the SCC RAD ORG the following lights are on: Pilot Gas On, Rad Organic On, Flame On Scanner #2, and Ready For Waste.

4. Inside Operator Rounds, 262-IOR-01, will perform a general inspection on the following skids: Local SCC Fuel Oil Skid, Remote SCC Burner Skid, SCC Fuel Oil Burner Skid, SCC Local RO Skid and SCC Remote Burner Skid.

All normal aspects of inspections and recording of parameters will be performed during operator rounds. Some of the specifics associated with the ROW System include inspection of the ROW Feed Pumps for leaks, and verification of the ROW Feed Pump discharge pressure. The following SCC RAD ORG. lights are verified ON in the Control Room:

- Pilot Gas On
- Rad Organics On
- Flame on Scanner #2
- Ready For Waste Light
- Inspection are also performed on the following skids:
- SCC Local Fuel Oil Burner Skid
- SCC Remote Burner Skid

Surveillances

261-SUR-FE-01 R, *FUGITIVE EMISSIONS MONTHLY INSPECTION (U)*. This procedure provides a method for Consolidated Incineration Facility (CIF) personnel to perform quarterly inspections of equipment in the Waste Tanks and Equipment (WTE), Waste Vent (WV), Blend Radioactive Waste (BRW) and Rad Organic Waste (ROW) systems for leakage which would result in fugitive emissions.

This procedure is performed quarterly for systems containing light liquid organic materials. Systems containing heavy liquid organic materials are inspected annually. Systems with components which have leakage are inspected monthly until leaking equipment has been repaired.

When a leak is detected, it must be tagged with the CLI Number, date of leak detection and organic concentration. Following repair of equipment other than valves, the tag may be removed. Following repair of valves that have leaked with emissions greater than 2,000 ppm the valve shall be tagged with CLI Number date of leak detection, concentration and date of repair. The tag must not be removed until the valve has successfully passed two (2) monthly inspections.

This procedure applies to the CIF, specifically the valves, seals, pumps, and agitators in the waste liquid systems which may contain light liquid organic materials.

Shutdown

To shut down the ROW System, the ROW Feed Pump Stroke Control is decreased to the Zero Fire position, the operating ROW Feed Pump is stopped, and ROW Transfer Valve 0609 is closed to isolate the ROW System from DWPF. This has the effect of placing the ROW System on Recirculation by stopping the feed flow (See Figure 1). The DWPF operator is then notified to stop the OWST Transfer Pump. Once the DWPF operator stops the OWST Pump, nitrogen purge to the transfer line should be verified to be maintaining pressure.

Infrequent Operation

Abnormal operations of the ROW System include all events that are not performed on a regular basis, and do not imply "something is wrong."

System Flushes

Occasionally, it may be necessary to perform a system flush of the ROW System to eliminate localized hot spots or for other reasons determined by the Shift Supervisor (SS). These flushes are normally performed using fuel oil. The ROW System is provided with flanged connections throughout the system to facilitate system flushes. Bypass lines around the ROW Feed Pumps allow use of the Fuel Oil Transfer Pump to provide the driving force for the flush. A 30-foot flush hose is provided to route the flush discharge to one of the Blended Waste Tanks. The hose must be manually installed.

ELO 2.05	**Given a description of the ROW System equipment status, STATE any corrective actions required to return system operation to a normal condition.**

Mandatory Shutdowns

Mandatory shutdowns are required to protect personnel, equipment, and the environment from the inadvertent release of Benzene. As stated before, Benzene is a known carcinogen, and it is also very flammable. The hazards associated with the ROW System require the utmost attention to personal safety to operate safely. The following conditions, as indicated on the DCS, will initiate or require a mandatory shutdown of the ROW Burner:

- ROW fuel pressure H-261-ROW-PALL-2303, BNR-004 PRESSURE LOW-LOW, <20 psig on DCS Point Tag Display ROW2303PA-1, SCC ROW P/T ALARMS
- ROW fuel pressure H-261-ROW-PAH-2303, BNR-004 HIGH PRESSURE, >80 psig on DCS Point Tag Display ROW2303PA-1, SCC ROW P/T ALARMS
- ROW Atomizing Steam pressure differential H-261-MS-PALL-2307, MAIN STEAM PRESSURE LOW-LOW, <20 psid on DCS Point Tag Display ROW2307PA-1, SCC ROW STM PRESS ALARMS
- ROW Atomizing Steam pressure differential H-261-INC-BAL-2715, MAIN STEAM PRESSURE HIGH, >40 psid on DCS Point Tag Display ROW2307PA-1, SCC ROW STM PRESS ALARMS
- Loss of flame to ROW Burner H-261-INC-BAL-2715, ROW #1 FLAME FAIL AND H-261-INC-BAL-2716, #2 FLAME FAIL" using DCS Point Tag Display ROW2717E-1, SCC ROW BURN CTRL SWITCH
- ROW transfer line H-262-ROW-PAL-0624, LOW OWST XFER PRESS of 1 psig OR H-261-ROW-TAL-0625, OWST XFER TEMP of 55 °F using DCS Point Tag Display ROW0624PA-1, OWST XFER P/T ALARMS

A complete mandatory shutdown is initiated upon receipt of indication of a ROW Transfer Line leak. This condition would be identified by (H-262-ROW-CA-0900-(B)) OWST LEAK DETECTOR" on DCS Point Tag Display ROW0901L-1, OWST LEVEL.

Abnormal Indications

Lack of Atomizing Steam Pressure

Because the burner guns have an internal mixing chamber, they are subject to variations in fuel/waste flow at any given pressure. A small drop in atomizing steam pressure can change the internal pressure of the mixing chamber resulting in an increase in the fuel/waste flow. The increase in fuel/waste flow will increase the BTU output which causes the burner to "overfire" at a pressure at which it normally would have sufficient combustion air.

Lack of Atomizing Steam Flow

A pluggage or flow restriction in the atomizing steam supply piping can cause a reduction in steam flow which could reduce the mixing chamber back pressure and have the same result as a loss of atomizing steam pressure.

Wet Steam

Since wet steam is lower in energy than dry steam, atomization with wet steam is not as effective. Lower energy atomization results in a larger fuel/waste droplet size and some oil coated water droplets dispersing into the combustion zone. The larger droplets and water coated droplets are slower burning and can lead to fireflies/sparklers on the internal firebox combustion air currents. The fireflies are a major source of ash and soot buildup on radiant convection heat transfer surfaces and the burners.

Cold/Heavy Fuel

Viscosity is the measure of the fluids resistance to flow. Fuels should be heated to the suggested viscosity range. Any reduction in the temperature results in increase in the viscosity. As the viscosity increases, the quality of atomization and combustion will decrease.

Atomizer/Tip Failure

The tip is subject to highly abrasive and corrosive fuel flows and, as a result, requires frequent maintenance, cleaning and sometimes replacement. Some of the effects of atomizer/tip deterioration are as follows:

- Enlargement of fuel orifice - high oil/waste flow, low atomizing steam to fuel ratio, poor atomization, burner overfiring
- Enlargement of atomizing steam orifices - High atomizing steam flow, low oil/waste flow, reduction in gun capacity, reduction in stability
- Enlargement of atomizer exit - lower mixing chamber pressure, reduction in steam quality, burner overfiring
- Deterioration of atomizer seal - steam bypassing atomizer, poor atomization, instability, poor flame pattern
- Deterioration of dispersion chamber - reduction of exit port, deterioration of dispersion pattern, coking, oil/waste spills

Low Fuel Flow/Pressure

Reduction in fuel firing rate or plugging of the fuel orifice can cause burner stability problems. Low fuel flow exit port velocity can cause burner dripping and oil spills.

High Atomizing Steam Pressure

High steam pressure increases the mixing chamber back pressure and thereby reduces oil flow which can cause stability problems.

Leaking Steam Purge Valve

A leaking steam purge valve can cause disruption of oil/waste flow to the gun resulting in burner instability.

High Atomizing Steam Temperature

High steam temperature can cause vaporization of the fuel in the burner gun. The vaporized fuel flowing through the orifices designed for liquid flow will reduce the oil gun capacity and stability. Sometimes, with heavy oil, the temperature can cause slugs to be formed resulting in smoke and poor atomization.

Summary

- The ROW System will only be in recirculation during Mode 1 operations.
- To shut down the ROW System, the DWPF operator is notified to stop the OWST Transfer Pump. Once the DWPF operator stops the OWST Pump, nitrogen purge to the transfer line should be verified to be maintaining pressure.
- Occasionally, it may be necessary to perform a system flush of the ROW System using the Fuel Oil Transfer Pump and a manually installed hose.
- There are several conditions requiring the mandatory shutdown of the ROW burner.
- A complete mandatory shutdown is initiated upon receipt of indication of a ROW Transfer Line leak.
- Many variables can affect the proper operation of the ROW burner gun.

PROCESS REQUIREMENTS

5.1 **EXPLAIN** how the Process Requirements associated with the ROW Handling System support the following areas:
Operational Controls

5.2 Using the Process Requirements, **IDENTIFY** the Process Conditions for Operation for the ROW System. Determine the appropriate required action(s) and time requirement(s) if a Condition is not met.

5.3 Using the Process Requirements, **DETERMINE** how verification is accomplished that the ROW is operating within the Process Conditions for Operation and the frequency that each of these items must be performed.

OPERATIONAL MODES

OPERATION	A MODE in which the PROCESS AREA is performing its intended function. For the Incineration Area, waste material is being fed or solid waste is present in the rotary kiln.
WARM STANDBY	A MODE in which the mission of the PROCESS AREA is not actively being performed. For the Incineration Area, all waste feed burners are off and the kiln temperature is greater than 300°F.
SHUTDOWN	A MODE in which the PROCESS AREA is not operating. The PROCESS AREA is not permitted to receive solid or liquid wastes, but may retain its inventory of MATERIAL. For the Incineration Area, kiln temperatures must be at or below 300°F.
COLD STANDBY	A MODE in which the PROCESS AREA is not operating. The PROCESS AREA is not allowed to receive MATERIAL. The major part of the MATERIAL inventory has been removed from the PROCESS AREA.

BASIS

LIQUID WASTE FEED CONTROLS

Liquid waste requirements ensure the incinerator will be operated in conformance with safety and environmental regulations. Waste characteristics for liquid waste feeds must be controlled to ensure that system design specifications and environmental permit requirements are satisfied. Liquid wastes are blended to obtain a solution with the desired heating value, viscosity, and ash and chlorine content for stable combustion in the Incinerator System.

The completion times and surveillance requirement frequencies for the requirements specified by this PCO are based on engineering judgment.

AUTOMATIC WASTE FEED CUTOFFS

Interlocks have been incorporated into the waste feed control circuit that will automatically shut down the liquid and solid waste feeds to the incinerator if certain parameters pertaining to the incinerator are out of limit. Actuation of these cutoffs will ensure that operational parameters will not exceed permit limits.

The RCRA Application, sections IIIE4.F.3 and IIIE5.D.4.C among others, specifies that a check of the waste feed cutoff interlocks shall be performed at least weekly, with some required to be tested monthly. SR 4.4.7.1 complies with this requirement by establishing appropriate frequencies for performance of a DCS check of the waste feed cutoff interlock INSTRUMENT LOOPS. Other waste feed cutoffs exist within the DCS and associated Waste Tracking System but are not covered by this PCO.

The completion times and surveillance requirement frequencies for the remaining requirements specified by this PCO are based on engineering judgment.

Overall Waste Feed Controls

Overall waste feed controls ensure that environmental permit requirements are satisfied. Process Requirements are established to limit the types of materials that may be incinerated. These requirements are delineated in the CIF Waste Acceptance Criteria and involve such things and involve such things as the specification of prohibited feed materials as well as quantitative limits related to transuranic isotopic concentrations, tritiated waste feeds, and a minimum heat of combustion for feed material. Adherence with the Waste Acceptance Criteria requirements is necessary to ensure compliance with applicable sections of the RCRA and National Emission Standards for Hazardous Air Pollutants Permits. Should these requirements be exceeded, SWEC personnel identified on the CIF Duty Response Team are notified within 1 hour.

LEVEL/LEAK DETECTION INSTRUMENTATION

A low-energy liquid release can occur as a result of transfer errors, overflows, chemical addition errors, spills, leaks, or corrosion. As a result of the potential radiological exposure to personnel, level detection and alarm loops are required for various tanks and equipment throughout CIF. Transfer errors, overflows, and spills are detected by liquid-level indicators and alarms in vessels and sumps. This equipment ensures that leaks and spills are detected in a timely manner. PRs are established to ensure that potential leaks, spills, and overflows are rapidly identified so that corrective actions can be initiated.

If required level instrumentation is inoperable, IMMEDIATE cessation of all transfers associated with the affected tank, sump, or equipment is required to minimize the potential for an actual leak or overflow being undetected. The quench, scrubber, and some sumps can not be isolated safely until the Incinerator Area is in SHUTDOWN. Alternatively, the establishment of surveillance of the affected tank, sump, or equipment will ensure that a postulated leak or overflow would not go undetected, and therefore serves as an effective compensatory measure provided it is performed IMMEDIATELY. The frequency of this surveillance is dependent upon plant conditions and should be specified by the Shift Manager/Supervisor.

The required surveillance frequency for the other surveillances is based on engineering judgment and permit requirements.

PROCESS CONDITIONS FOR OPERATION

Liquid Waste Feed Controls

PCO: High-Heat Value (HHV) and Low-Heat Value (LHV) liquid waste feeds shall have the characteristics of Table 3.4.6-1.

AND liquid waste feed flow meter shall be OPERABLE for each LHV and HHV liquid waste feed line.

AND The waste burner steam atomization pressures shall be greater than or equal to the values listed in Table 3.4.6-2.

Overall Waste Feed Controls

The hourly rolling average feed rates to the incinerator shall be no greater than 900 lb/hr Solids Feed, 385 lb/hr Blended Rad. Waste Feed, 950 lb/hr Aqueous Waste Feed, and 191 lb/hr Rad. Organic Waste Feed for a total feed rate limit of 2,426 lb/hr.

AND The rolling average chlorine feed rate of the combined waste feeds shall be maintained less than or equal to 219 lb/hr.

AND The rolling average ash feedrate of the combined liquid feeds shall be maintained less than or equal to 30 lbs/hr

AND The metals listed in Table 3.4.2-1 introduced to the incinerator (as metals or metal compounds) via waste or fuel oil shall have hourly rolling average feed rates less than or equal to the values indicated in the table.

Level/ Leak Detection Instrumentation

The tanks and sumps shown in Table 3.2.1-1 shall be serviced by OPERABLE level instrumentation.

REQUIRED ACTIONS FOR PCO VIOLATIONS

LIQUID WASTE FEED CONTROLS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. A requirement of Table 3.4.6-1 is not met. OR A liquid waste feed flow rate meter is not OPERABLE for each LHV and HHV liquid waste feed line.	A.1 Return the value to acceptable limits. OR A.2 Stop feeds on the affected line(s).	IMMEDIATELY IMMEDIATELY
B. A requirement of Table 3.4.6-2 is not met.	B.1 Return the applicable pressure(s) to acceptable levels. OR Stop feeds on affected line(s).	IMMEDIATELY IMMEDIATELY

Level/ Leak Detection Instrumentation

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. A tank or sump in Table 3.2.1-1 has no INSTRUMENT LOOP OPERABLE.	A.1 Stop all transfers associated with the affected tank, sump, or equipment. <u>OR</u> A.2 Establish surveillance of the level of the affected tank or sump.	IMMEDIATELY IMMEDIATELY

Automatic Waste Feed Cutoffs

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. A required waste feed cutoff interlock is inoperable.	A.1 Stop all solid and liquid waste feed operations.	IMMEDIATELY

PCO VERIFICATION

Process Conditions for Operation verification is accomplished for each area by continuous plant monitoring and Surveillance Requirements. The Surveillance Requirements include but are not limited to items included on Operator Rounds, instrument loop checks and calibration, equipment alignment checks, functional tests, response checks, and verification checks. Associated with the Surveillance Requirements are frequency requirements which must be performed in accordance with the particular mode in which the plant is operating.

SRs are an integral part of the PCO and ensure compliance with the PCO. The surveillances are performed on a frequency schedule as specified in the individual SR. The following table indicates each surveillance frequency and its meaning:

<u>Notation</u>	<u>Frequency</u>
Shiftly	At least once each 12 hour shift
Daily	At least once each day
2 Days	At least once every 2 days
5 Days	At least once every 5 days
7 Days	At least once every 7 days

14 Days	At least once every 14 days
1 Month	At least once every 30 days
2 Months	At least once every 60 days
3 Months	At least once every 90 days
6 Months	At least once every 183 days
1 Year	At least once every 365 days
3 Years	At least once every 1095 days

The specified frequency of an SR is met if the SR is performed within 1.25 times the interval specified in the frequency. The 25% allowance is not applicable to environmental permit surveillances (EPSs), except for those surveillances with

“7 days” or “1 month” frequencies. EPSs are designated by an “(R)” after the COMPLETION TIME. The 25% allowance is also not applicable to conditional SRs. If a Completion Time in a Required Action requires periodic performance on a "hourly" type basis, the 25% extension applies to each performance after the initial performance.

Failure to perform an SR within the specified interval of SR 4.0.2, as well as failure to meet an SR, shall constitute failure to meet the PCO OPERABILITY requirements. The PCO ACTIONS shall be entered when it is determined that the SR has not been performed. If discovered that an SR was not performed within the specified interval of SR 4.0.2, a delay period of the lesser of 24 Hours or up to the limit of the specified frequency is provided to permit completion of the SR prior to entering the ACTIONS. If the SR is not performed within the delay period, entry into the applicable Required Action(s) occurs IMMEDIATELY upon expiration of the delay period. When the SR is performed within the delay period and the SR is not met, entry into the applicable Required Action(s) occurs IMMEDIATELY upon failure to meet the SR. The delay period is not applicable to nonperiodic or conditional SRs unless specifically noted in the frequency. Exceptions to the delay period of SR 4.0.3 are stated in individual SRs.